

## Triangle Geometry

To duplicate the results of this benchmarking document exactly, build your triangle unit cell using the following code:

```
% INITIALIZE MATLAB
close all;
clc;
clear all;

% UNITS
meters = 1;
centimeters = 1e-2 * meters;
degrees = pi/180;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%% STEP 1: INITIALIZE PARAMETERS
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% SOURCE PARAMETERS
lam0 = 2 * centimeters;           %free space wavelength
theta = 0 * degrees;
phi = 0 * degrees;
pte = 1;
ptm = 0;

% DEVICE PARAMETERS
ur1 = 1.0;                         %permeability in reflection region
er1 = 2.0;                         %permittivity in reflection region
ur2 = 1.0;                         %permeability in transmission region
er2 = 9.0;                         %permittivity in transmission region
urd = 1.0;                         %permeability of device
erd = 6.0;                         %permittivity of device
Lx = 1.75 * centimeters;          %period along x
Ly = 1.5 * centimeters;          %period along y
d1 = 0.5 * centimeters;          %thickness of layer 1
d2 = 0.3 * centimeters;          %thickness of layer 2
w = 0.8*Ly;

% RCWA PARAMETERS
Nx = 512;                          %number of point along x in real-space grid
Ny = round(Nx*Ly/Lx);              %number of point along y in real-space grid
PQ = 3 * [1 1];                    %number of spatial harmonics along x and y

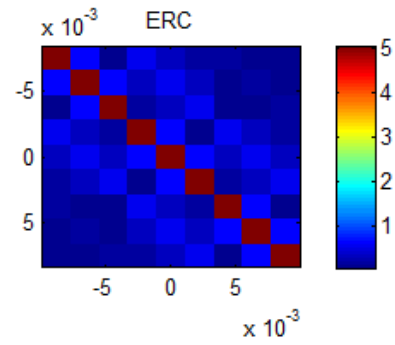
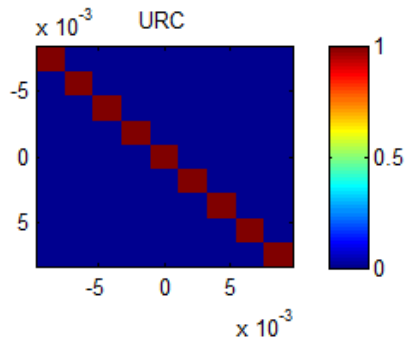
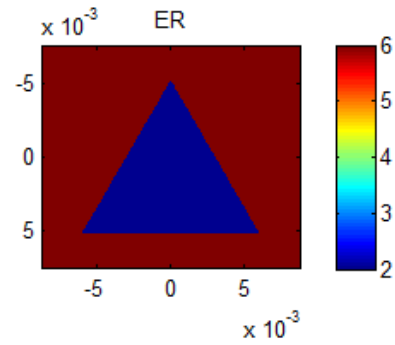
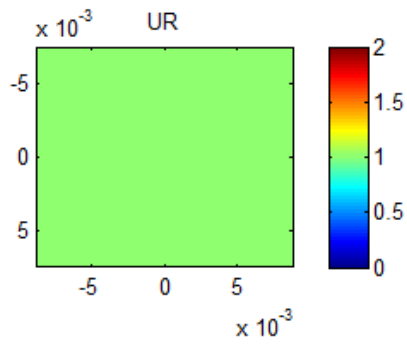
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%% STEP 2: BUILD DEVICE LAYERS ON HIGH RESOLUTION GRID
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% CROSS SECTIONAL GRID
dx = Lx/Nx;                         %grid resolution along x
dy = Ly/Ny;                         %grid resolution along y
xa = [0:Nx-1]*dx;                   %x axis array
xa = xa - mean(xa);                 %center x axis at zero
ya = [0:Ny-1]*dy;                   %y axis vector
ya = ya - mean(ya);                 %center y axis at zero

% INITIALIZE LAYERS TO er AND ur
UR = urd * ones(Nx,Ny,2);
ER = erd * ones(Nx,Ny,2);

% BUILD LAYER 1 (TRIANGLE)
h = 0.5*sqrt(3)*w;
ny = round(h/dy);
ny1 = round((Ny - ny)/2);
ny2 = ny1 + ny - 1;
for ny = ny1 : ny2
    f = (ny - ny1)/(ny2 - ny1);
    nx = round(f*w/Lx*Nx);
    nx1 = 1 + floor((Nx - nx)/2);
    nx2 = nx1 + nx;
    ER(nx1:nx2,ny,1) = er1;
end
```

## Data Visualization



# The Data

```
*****
***** RCWA BENCHMARKING DOCUMENT *****
***** 3x3 Spatial Harmonics *****
*****
```

===== UNITS  
meters = 1

===== STEP 1: DASHBOARD

```
lam0 = 0.02
theta = 0 deg.
phi = 0 deg.
pte = 1
ptm = 0
```

```
ur1 = 1
er1 = 2
ur2 = 1
er2 = 9
```

```
urd = 1
erd = 6
Lx = 0.0175
Ly = 0.015
d1 = 0.005
d2 = 0.003
w = 0.012
```

```
Nx = 512
Ny = 439
P = 3
Q = 3
```

===== STEP 2: BUILD DEVICE

```
dx = 3.418e-05
dy = 3.4169e-05
```

===== STEP 3: CONVOLUTION MATRICES

```
NH = 9
NLAY = 2
```

LAYER 1...

```
URC =
 1  0  0  0  0  0  0  0  0
 0  1  0  0  0  0  0  0  0
 0  0  1  0  0  0  0  0  0
 0  0  0  1  0  0  0  0  0
 0  0  0  0  1  0  0  0  0
 0  0  0  0  0  1  0  0  0
 0  0  0  0  0  0  1  0  0
 0  0  0  0  0  0  0  1  0
 0  0  0  0  0  0  0  0  1
```

```
ERC =
Columns 1 through 6
```

```
5.0449 + 0.0000i  0.6360 - 0.0020i -0.1402 + 0.0008i  0.3671 + 0.4094i -0.3056 - 0.1696i  0.1402 - 0.1531i
0.6360 + 0.0020i  5.0449 + 0.0000i  0.6360 - 0.0020i -0.3045 - 0.1715i  0.3671 + 0.4094i -0.3056 - 0.1696i
-0.1402 - 0.0008i  0.6360 + 0.0020i  5.0449 + 0.0000i  0.1421 - 0.1514i -0.3045 - 0.1715i  0.3671 + 0.4094i
0.3671 - 0.4094i -0.3045 + 0.1715i  0.1421 + 0.1514i  5.0449 + 0.0000i  0.6360 - 0.0020i -0.1402 + 0.0008i
-0.3056 + 0.1696i  0.3671 - 0.4094i -0.3045 + 0.1715i  0.6360 + 0.0020i  5.0449 + 0.0000i  0.6360 - 0.0020i
0.1402 + 0.1531i -0.3056 + 0.1696i  0.3671 - 0.4094i -0.1402 - 0.0008i  0.6360 + 0.0020i  5.0449 + 0.0000i
0.2044 + 0.0362i -0.0687 - 0.0222i -0.0733 - 0.0433i  0.3671 - 0.4094i -0.3045 + 0.1715i  0.1421 + 0.1514i
-0.0686 - 0.0227i  0.2044 + 0.0362i -0.0687 - 0.0222i -0.3056 + 0.1696i  0.3671 - 0.4094i -0.3045 + 0.1715i
-0.0727 - 0.0443i -0.0686 - 0.0227i  0.2044 + 0.0362i  0.1402 + 0.1531i -0.3056 + 0.1696i  0.3671 - 0.4094i
```

```
Columns 7 through 9
```

```
0.2044 - 0.0362i -0.0686 + 0.0227i -0.0727 + 0.0443i
-0.0687 + 0.0222i  0.2044 - 0.0362i -0.0686 + 0.0227i
-0.0733 + 0.0433i -0.0687 + 0.0222i  0.2044 - 0.0362i
0.3671 + 0.4094i -0.3056 - 0.1696i  0.1402 - 0.1531i
-0.3045 - 0.1715i  0.3671 + 0.4094i -0.3056 - 0.1696i
0.1421 - 0.1514i -0.3045 - 0.1715i  0.3671 + 0.4094i
5.0449 + 0.0000i  0.6360 - 0.0020i -0.1402 + 0.0008i
0.6360 + 0.0020i  5.0449 + 0.0000i  0.6360 - 0.0020i
-0.1402 - 0.0008i  0.6360 + 0.0020i  5.0449 + 0.0000i
```

LAYER 2...

```
URC =
 1  0  0  0  0  0  0  0  0
 0  1  0  0  0  0  0  0  0
 0  0  1  0  0  0  0  0  0
 0  0  0  1  0  0  0  0  0
 0  0  0  0  1  0  0  0  0
 0  0  0  0  0  1  0  0  0
 0  0  0  0  0  0  1  0  0
 0  0  0  0  0  0  0  1  0
 0  0  0  0  0  0  0  0  1
```

RCWA Benchmark Data  
3x3 Spatial Harmonics



```
ERC =
  6   0   0   0   0   0   0   0   0
  0   6   0   0   0   0   0   0   0
  0   0   6   0   0   0   0   0   0
  0   0   0   6   0   0   0   0   0
  0   0   0   0   6   0   0   0   0
  0   0   0   0   0   6   0   0   0
  0   0   0   0   0   0   6   0   0
  0   0   0   0   0   0   0   6   0
  0   0   0   0   0   0   0   0   6
```

===== STEP 4: WAVE VECTOR EXPANSION

```
I =
  1   0   0   0   0   0   0   0   0
  0   1   0   0   0   0   0   0   0
  0   0   1   0   0   0   0   0   0
  0   0   0   1   0   0   0   0   0
  0   0   0   0   1   0   0   0   0
  0   0   0   0   0   1   0   0   0
  0   0   0   0   0   0   1   0   0
  0   0   0   0   0   0   0   1   0
  0   0   0   0   0   0   0   0   1
```

```
Z =
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
```

```
n1 = 1.4142
n2 = 3
k0 = 314.1593
kinc = [0;0;1.4142]
```

```
p = [-1  0  1]
q = [-1  0  1]
```

```
Kx =
  1.1429   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   -1.1429   0   0   0   0   0   0
  0   0   0   1.1429   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   -1.1429   0   0   0
  0   0   0   0   0   0   1.1429   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   -1.1429
```

```
Ky =
  1.3333   0   0   0   0   0   0   0   0
  0   1.3333   0   0   0   0   0   0   0
  0   0   1.3333   0   0   0   0   0   0
  0   0   0   1.3333   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   -1.3333   0   0
  0   0   0   0   0   0   0   -1.3333   0
  0   0   0   0   0   0   0   0   -1.3333
```

```
Kzref =
Columns 1 through 6
```

```
0.0000 + 1.0411i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i -0.4714 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 1.0411i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i -0.8330 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i -1.4142 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i -0.8330 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
```

```
Columns 7 through 9
```

```
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 1.0411i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i -0.4714 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 1.0411i
```

```
Kztrn =
  2.4323   0   0   0   0   0   0   0   0
  0   2.6874   0   0   0   0   0   0   0
  0   0   2.4323   0   0   0   0   0   0
  0   0   0   2.7738   0   0   0   0   0
  0   0   0   0   3.0000   0   0   0   0
  0   0   0   0   0   2.7738   0   0   0
  0   0   0   0   0   0   2.4323   0   0
  0   0   0   0   0   0   0   2.6874   0
  0   0   0   0   0   0   0   0   2.4323
```









RCWA Benchmark Data
3x3 Spatial Harmonics

Table with 8 columns of complex numbers (real and imaginary parts) representing spatial harmonics.

Columns 7 through 12

Table with 8 columns of complex numbers, continuing the spatial harmonics data.

Columns 13 through 18

Table with 8 columns of complex numbers, continuing the spatial harmonics data.

Q =

Columns 1 through 6

Table with 8 columns of real numbers representing the Q matrix.

Columns 7 through 12

Table with 8 columns of real numbers, continuing the Q matrix data.



RCWA Benchmark Data  
3x3 Spatial Harmonics



Columns 13 through 18

0.3671 + 0.4094i	-0.3056 - 0.1696i	0.1402 - 0.1531i	0.2044 - 0.0362i	-0.0686 + 0.0227i	-0.0727 + 0.0443i
-0.3045 - 0.1715i	0.3671 + 0.4094i	-0.3056 - 0.1696i	-0.0687 + 0.0222i	0.2044 - 0.0362i	-0.0686 + 0.0227i
0.1421 - 0.1514i	-0.3045 - 0.1715i	0.3671 + 0.4094i	-0.0733 + 0.0433i	-0.0687 + 0.0222i	0.2044 - 0.0362i
3.7388 + 0.0000i	0.6360 - 0.0020i	-0.1402 + 0.0008i	0.3671 + 0.4094i	-0.3056 - 0.1696i	0.1402 - 0.1531i
0.6360 + 0.0020i	5.0449 + 0.0000i	0.6360 - 0.0020i	-0.3045 - 0.1715i	0.3671 + 0.4094i	-0.3056 - 0.1696i
-0.1402 - 0.0008i	0.6360 + 0.0020i	3.7388 + 0.0000i	0.1421 - 0.1514i	-0.3045 - 0.1715i	0.3671 + 0.4094i
0.3671 - 0.4094i	-0.3045 + 0.1715i	0.1421 + 0.1514i	3.7388 + 0.0000i	0.6360 - 0.0020i	-0.1402 + 0.0008i
-0.3056 + 0.1696i	0.3671 - 0.4094i	-0.3045 + 0.1715i	0.6360 + 0.0020i	5.0449 + 0.0000i	0.6360 - 0.0020i
0.1402 + 0.1531i	-0.3056 + 0.1696i	0.3671 - 0.4094i	-0.1402 - 0.0008i	0.6360 + 0.0020i	3.7388 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	1.5238 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-1.5238 + 0.0000i

OMEGA\_SQ =  
Columns 1 through 6

-1.9114 + 0.0048i	-0.4630 + 0.0086i	0.0275 - 0.0163i	-0.4076 - 0.4288i	0.2239 + 0.1024i	-0.0311 + 0.0989i
-0.6360 - 0.0020i	-3.2671 + 0.0000i	-0.6360 + 0.0020i	0.3045 + 0.1715i	-0.3671 - 0.4094i	0.3056 + 0.1696i
0.0277 - 0.0159i	-0.4630 + 0.0057i	-1.9114 + 0.0048i	-0.0323 + 0.0985i	0.2232 + 0.1037i	-0.4076 - 0.4288i
-0.4106 + 0.4244i	0.2186 - 0.1057i	-0.0229 - 0.0911i	-3.6678 + 0.0000i	-0.4540 + 0.0014i	0.0084 - 0.0000i
0.3056 - 0.1696i	-0.3671 + 0.4094i	0.3045 - 0.1715i	-0.6360 - 0.0020i	-5.0449 + 0.0000i	-0.6360 + 0.0020i
-0.0217 - 0.0914i	0.2192 - 0.1044i	-0.4106 + 0.4244i	0.0084 + 0.0000i	-0.4540 - 0.0014i	-3.6678 + 0.0000i
-0.1973 + 0.0475i	0.0388 + 0.0014i	0.0210 + 0.0393i	-0.4076 + 0.4288i	0.2232 - 0.1037i	-0.0323 - 0.0985i
0.0686 + 0.0227i	-0.2044 - 0.0362i	0.0687 + 0.0222i	0.3056 - 0.1696i	-0.3671 + 0.4094i	0.3045 - 0.1715i
0.0206 + 0.0396i	0.0389 + 0.0017i	-0.1973 + 0.0475i	-0.0311 - 0.0989i	0.2239 - 0.1024i	-0.4076 + 0.4288i
0.0578 + 0.0056i	0.2018 + 0.0077i	-0.1315 - 0.0180i	-0.0473 - 0.0226i	-0.0953 - 0.0785i	0.1273 - 0.0632i
-0.2418 - 0.0227i	0.0000 + 0.0000i	0.2420 + 0.0212i	0.1405 + 0.0817i	0.0000 - 0.0000i	-0.1410 - 0.0809i
0.1313 + 0.0196i	-0.2018 - 0.0089i	-0.0578 - 0.0056i	-0.1281 + 0.0617i	0.0948 + 0.0791i	0.0473 + 0.0226i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
-0.0083 + 0.0131i	0.0348 + 0.0243i	0.0610 + 0.0048i	0.0473 - 0.0226i	0.0948 - 0.0791i	-0.1281 - 0.0617i
-0.0051 - 0.0323i	0.0000 + 0.0000i	0.0053 + 0.0322i	-0.1410 + 0.0809i	0.0000 + 0.0000i	0.1405 - 0.0817i
-0.0609 - 0.0055i	-0.0347 - 0.0245i	0.0083 - 0.0131i	0.1273 + 0.0632i	-0.0953 + 0.0785i	-0.0473 + 0.0226i

Columns 7 through 12

-0.1973 + 0.0475i	0.0389 - 0.0017i	0.0206 - 0.0396i	0.0486 - 0.0009i	-0.0445 + 0.0101i	0.0142 - 0.0005i
0.0687 - 0.0222i	-0.2044 + 0.0362i	0.0686 - 0.0227i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0210 - 0.0393i	0.0388 - 0.0014i	-0.1973 + 0.0475i	-0.0142 + 0.0003i	0.0446 - 0.0099i	-0.0486 + 0.0009i
-0.4106 + 0.4244i	0.2192 + 0.1044i	-0.0217 + 0.0914i	-0.1309 + 0.1590i	0.1124 - 0.1024i	-0.0643 - 0.0320i
0.3045 + 0.1715i	-0.3671 - 0.4094i	0.3056 + 0.1696i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
-0.0229 + 0.0911i	0.2186 + 0.1057i	-0.4106 - 0.4244i	0.0639 + 0.0328i	-0.1131 + 0.1017i	0.1309 - 0.1590i
-1.9114 + 0.0048i	-0.4630 - 0.0057i	0.0277 + 0.0159i	-0.1279 - 0.0573i	0.0543 + 0.0573i	0.0549 + 0.0055i
-0.6360 - 0.0020i	-3.2671 + 0.0000i	-0.6360 + 0.0020i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0275 + 0.0163i	-0.4630 + 0.0086i	-1.9114 + 0.0048i	-0.0548 - 0.0062i	-0.0540 - 0.0577i	0.1279 + 0.0573i
0.0083 + 0.0131i	-0.0347 + 0.0245i	-0.0609 + 0.0055i	-1.9043 - 0.0011i	-0.6879 + 0.0138i	0.1568 - 0.0014i
0.0053 + 0.0323i	0.0000 + 0.0000i	-0.0051 + 0.0323i	-0.6863 - 0.0075i	-3.1907 - 0.0069i	-0.6864 - 0.0032i
0.0610 - 0.0048i	0.0348 + 0.0243i	-0.0083 - 0.0131i	0.1568 + 0.0005i	-0.6880 + 0.0095i	-1.9043 + 0.0011i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.3671 + 0.4094i	0.3045 - 0.1715i	-0.1421 - 0.1514i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.3056 - 0.1696i	-0.3671 + 0.4094i	0.3045 - 0.1715i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.1402 - 0.1531i	0.3056 - 0.1696i	-0.3671 + 0.4094i
-0.0578 + 0.0056i	-0.2018 + 0.0089i	0.1313 - 0.0196i	-0.0552 + 0.0306i	0.0053 - 0.0447i	0.0093 + 0.0370i
0.2420 - 0.0212i	0.0000 + 0.0000i	-0.2418 + 0.0227i	0.0177 - 0.0372i	-0.0419 + 0.0593i	0.0174 - 0.0374i
-0.1315 + 0.0180i	0.2018 - 0.0077i	0.0578 - 0.0056i	0.0088 + 0.0371i	0.0056 - 0.0446i	-0.0552 + 0.0306i

Columns 13 through 18

0.1344 + 0.1209i	-0.1187 - 0.0661i	0.0664 - 0.0351i	0.1279 - 0.0573i	-0.0540 + 0.0577i	-0.0548 + 0.0062i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
-0.0668 + 0.0343i	0.1183 + 0.0669i	-0.1344 - 0.1209i	0.0549 - 0.0055i	0.0543 - 0.0573i	-0.1279 + 0.0573i
0.0000 + 0.0063i	0.0000 + 0.0071i	0.0000 + 0.0052i	0.1309 + 0.1590i	-0.1131 - 0.1017i	0.0639 - 0.0328i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 - 0.0052i	0.0000 - 0.0071i	0.0000 - 0.0063i	-0.0643 + 0.0320i	0.1124 + 0.1024i	-0.1309 - 0.1590i
-0.1344 + 0.1209i	0.1183 - 0.0669i	-0.0668 - 0.0343i	-0.0486 - 0.0009i	0.0446 + 0.0099i	-0.0142 - 0.0003i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0664 + 0.0351i	-0.1187 + 0.0661i	0.1344 - 0.1209i	0.0142 + 0.0005i	-0.0445 - 0.0101i	0.0486 + 0.0009i
-0.2103 - 0.2683i	0.1671 + 0.0925i	-0.0627 + 0.1121i	-0.0552 - 0.0306i	0.0056 + 0.0446i	0.0088 - 0.0371i
0.1573 + 0.1066i	-0.1942 - 0.2557i	0.1580 + 0.1056i	0.0174 + 0.0374i	-0.0419 - 0.0593i	0.0177 + 0.0372i
-0.0641 + 0.1113i	0.1665 + 0.0935i	-0.2103 - 0.2683i	0.0093 - 0.0370i	0.0053 + 0.0447i	-0.0552 - 0.0306i
-3.7388 + 0.0000i	-0.6360 + 0.0020i	0.1402 - 0.0008i	-0.3671 - 0.4094i	0.3056 + 0.1696i	-0.1402 + 0.1531i
-0.6360 - 0.0020i	-5.0449 + 0.0000i	-0.6360 + 0.0020i	0.3045 + 0.1715i	-0.3671 - 0.4094i	0.3056 + 0.1696i
0.1402 + 0.0008i	-0.6360 - 0.0020i	-3.7388 + 0.0000i	-0.1421 + 0.1514i	0.3045 + 0.1715i	-0.3671 - 0.4094i
-0.2103 + 0.2683i	0.1665 - 0.0935i	-0.0641 - 0.1113i	-1.9043 + 0.0011i	-0.6880 - 0.0095i	0.1568 - 0.0005i
0.1580 - 0.1056i	-0.1942 + 0.2557i	0.1573 - 0.1066i	-0.6864 + 0.0032i	-3.1907 + 0.0069i	-0.6863 + 0.0075i
-0.0627 - 0.1121i	0.1671 - 0.0925i	-0.2103 + 0.2683i	0.1568 + 0.0014i	-0.6879 - 0.0138i	-1.9043 + 0.0011i

W =  
Columns 1 through 6

-0.0245 + 0.0071i	0.0171 + 0.0087i	0.0842 - 0.1935i	-0.0484 + 0.3580i	-0.1082 + 0.0522i	0.0288 - 0.3773i
0.0963 + 0.1321i	-0.0000 - 0.0000i	-0.0001 - 0.0000i	0.0714 - 0.3367i	0.0000 + 0.0000i	-0.0070 + 0.2541i
-0.0246 + 0.0070i	-0.0171 - 0.0088i	-0.0851 + 0.1930i	-0.0505 + 0.3577i	0.1084 - 0.0516i	0.0311 - 0.3770i
0.1862 - 0.0006i	-0.0001 - 0.0143i	0.1158 + 0.1453i	-0.1491 - 0.1706i	-0.0357 - 0.0354i	-0.0474 + 0.0442i
0.9341 + 0.0000i	0.0001 + 0.0000i	0.0001 - 0.0001i	0.1809 + 0.2083i	-0.0000 + 0.0000i	0.0466 - 0.0432i
0.1862 + 0.0006i	-0.0001 + 0.0143i	-0.1151 - 0.1459i	-0.1481 - 0.1715i	0.0355 + 0.0355i	-0.0477 + 0.0439i
-0.0246 - 0.0070i	-0.0171 + 0.0088i	-0.2073 + 0.0389i	0.3613 + 0.0000i	0.0511 - 0.1087i	0.3783 - 0.0023i
0.0963 - 0.1321i	-0.0000 + 0.0000i	0.0000 + 0.0001i	-0.3434 + 0.0236i	-0.0000 - 0.0000i	-0.2538 - 0.0124i
-0.0245 - 0.0071i	0.0171 - 0.0087i	0.2076 - 0.0380i	0.3612 + 0.0021i	-0.0517 + 0.1084i	0.3784 + 0.0000i
0.0156 + 0.0160i	-0.0162 + 0.0101i	0.0802 - 0.3531i	-0.0251 - 0.1202i	0.3658 + 0.0000i	-0.1065 + 0.2286i
0.0000 + 0.0000i	0.0353 + 0.0796i	-0.0866 + 0.2976i	0.0000 - 0.0000i	-0.2767 - 0.0277i	0.0000 - 0.0000i
-0.0155 - 0.0161i	-0.0162 + 0.0009i	0.0824 - 0.3526i	0.0243 + 0.1204i	0.3657 + 0.0022i	0.1079 - 0.2278i
0.0000 - 0.0062i	0.2673 - 0.0008i	-0.0926 + 0.0739i	0.0236 - 0.0206i	-0.2026 + 0.2049i	-0.0855 - 0.0917i
0.0001 + 0.0000i	0.9160 + 0.0000i	0.0715 - 0.0568i	0.0000 + 0.0000i	0.2014 - 0.2024i	-0.0000 + 0.0000i

# RCWA Benchmark Data 3x3 Spatial Harmonics

```

0.0000 + 0.0062i  0.2673 + 0.0008i -0.0931 + 0.0734i -0.0237 + 0.0204i -0.2039 + 0.2037i  0.0849 + 0.0922i
-0.0155 + 0.0161i -0.0162 - 0.0009i  0.3621 + 0.0000i  0.1159 + 0.0409i -0.0040 - 0.3657i  0.2354 - 0.0902i
0.0000 - 0.0000i  0.0353 - 0.0796i -0.3095 + 0.0166i -0.0000 + 0.0000i  0.0290 + 0.2765i  0.0000 - 0.0000i
0.0156 - 0.0160i -0.0162 - 0.0010i  0.3620 + 0.0023i -0.1155 - 0.0417i -0.0018 - 0.3657i -0.2360 + 0.0888i
    
```

Columns 7 through 12

```

-0.3434 + 0.1850i  0.1041 - 0.1473i -0.4571 + 0.0028i  0.1015 + 0.0270i  0.0982 - 0.1664i -0.0159 - 0.0567i
-0.0000 + 0.0000i -0.1323 + 0.1068i  0.0000 + 0.0000i -0.1513 - 0.0365i  0.0840 - 0.5859i  0.0000 - 0.0002i
0.3446 - 0.1829i  0.1050 - 0.1467i  0.4572 + 0.0000i  0.1014 + 0.0276i  0.0993 - 0.1659i  0.0156 + 0.0566i
-0.0353 - 0.1398i -0.0858 + 0.0296i  0.0730 + 0.0203i  0.0100 - 0.0297i  0.1705 - 0.1487i -0.1001 - 0.0795i
-0.0000 + 0.0000i -0.0881 - 0.0301i -0.0000 + 0.0000i  0.0188 - 0.0554i -0.0604 + 0.0523i -0.0000 + 0.0000i
0.0344 + 0.1400i -0.0860 + 0.0290i -0.0728 - 0.0208i  0.0101 - 0.0297i  0.1714 - 0.1477i  0.0997 + 0.0800i
0.3902 + 0.0000i  0.1727 + 0.0520i -0.3899 - 0.2388i -0.0973 - 0.0397i  0.1783 - 0.0747i -0.0587 - 0.0027i
-0.0000 - 0.0000i -0.1700 - 0.0036i -0.0000 - 0.0000i  0.1423 + 0.0630i  0.5919 + 0.0000i  0.0002 - 0.0000i
-0.3901 - 0.0024i  0.1724 + 0.0529i  0.3884 + 0.2412i -0.0970 - 0.0403i  0.1787 - 0.0736i  0.0588 + 0.0029i
0.1537 - 0.2306i  0.3219 - 0.2486i  0.1623 + 0.0734i -0.4747 + 0.0029i  0.0211 + 0.0446i -0.0359 - 0.2231i
-0.0399 + 0.1113i -0.0000 - 0.0000i -0.0506 - 0.0288i  0.0000 + 0.0000i  0.0000 + 0.0001i -0.1325 - 0.5824i
0.1552 - 0.2297i -0.3235 + 0.2466i  0.1618 + 0.0744i  0.4747 + 0.0000i -0.0208 - 0.0446i -0.0345 - 0.2234i
-0.0733 + 0.0185i  0.0815 + 0.2365i -0.0216 + 0.0777i  0.0154 + 0.0052i -0.0824 - 0.0944i  0.0828 - 0.1044i
0.0523 - 0.0130i  0.0000 - 0.0000i  0.0207 - 0.0733i -0.0000 + 0.0000i -0.0000 + 0.0000i  0.0052 - 0.0065i
-0.0734 + 0.0181i -0.0800 - 0.2370i -0.0221 + 0.0776i -0.0154 - 0.0053i  0.0818 + 0.0950i  0.0834 - 0.1039i
0.2448 + 0.1301i -0.4067 + 0.0025i -0.1769 - 0.0211i -0.3769 - 0.2886i  0.0412 + 0.0269i  0.2255 - 0.0159i
-0.0874 - 0.0796i  0.0000 + 0.0000i  0.0582 + 0.0019i -0.0000 + 0.0000i -0.0001 - 0.0000i  0.5973 + 0.0000i
0.2439 + 0.1316i  0.4067 + 0.0000i -0.1767 - 0.0222i  0.3751 + 0.2909i -0.0411 - 0.0272i  0.2255 - 0.0145i
    
```

Columns 13 through 18

```

0.0471 + 0.0237i  0.0267 + 0.0393i  0.1071 + 0.1438i -0.0282 - 0.0623i -0.1408 + 0.2306i -0.0722 - 0.0684i
0.0000 + 0.0000i -0.4648 - 0.1353i -0.0000 + 0.0001i -0.0356 - 0.1138i -0.3852 + 0.3472i  0.0022 + 0.0057i
-0.0470 - 0.0240i  0.0264 + 0.0395i -0.1062 - 0.1446i -0.0277 - 0.0623i -0.1414 + 0.2277i  0.0756 + 0.0738i
0.0682 + 0.1232i  0.4944 - 0.0033i  0.6120 + 0.0000i -0.0003 + 0.0019i  0.0643 + 0.1672i  0.0018 - 0.0496i
0.0000 - 0.0000i -0.1296 + 0.0004i  0.0000 + 0.0000i  0.0000 - 0.0056i -0.0881 - 0.2293i -0.0029 + 0.0000i
-0.0675 - 0.1236i  0.4944 + 0.0000i -0.6120 - 0.0040i  0.0003 + 0.0019i  0.0642 + 0.1672i  0.0021 + 0.0496i
-0.0049 + 0.0525i  0.0261 - 0.0397i  0.1072 - 0.1439i  0.0281 - 0.0622i  0.2575 + 0.0744i  0.0751 - 0.0743i
0.0000 - 0.0000i -0.4639 + 0.1384i  0.0000 + 0.0001i  0.0363 - 0.1136i  0.5186 + 0.0000i  0.0021 - 0.0057i
0.0052 - 0.0525i  0.0264 - 0.0395i -0.1080 + 0.1431i  0.0286 - 0.0622i  0.2590 + 0.0770i -0.0718 + 0.0689i
0.0709 - 0.0038i  0.0026 + 0.0445i -0.0039 - 0.0488i  0.0506 + 0.1229i  0.0781 - 0.0800i  0.1954 + 0.1714i
0.4892 + 0.0000i  0.0000 + 0.0001i -0.1734 - 0.0225i  0.0001 + 0.0000i  0.0018 - 0.0027i  0.1788 + 0.2497i
0.0710 - 0.0034i -0.0023 - 0.0445i -0.0037 - 0.0490i -0.0498 - 0.1232i -0.0766 + 0.0743i  0.1954 + 0.1750i
-0.4030 + 0.2232i  0.0004 + 0.0659i  0.0006 - 0.1595i  0.6641 + 0.0000i  0.0064 - 0.0075i  0.4414 - 0.0029i
0.1410 - 0.0775i  0.0000 + 0.0000i -0.0001 + 0.0211i  0.0000 - 0.0000i  0.0012 + 0.0032i -0.3191 + 0.0010i
-0.4043 + 0.2207i -0.0001 - 0.0659i  0.0005 - 0.1595i -0.6641 - 0.0039i -0.0098 - 0.0013i  0.4414 + 0.0000i
0.0409 - 0.0581i -0.0020 + 0.0445i  0.0040 - 0.0490i  0.0505 - 0.1229i  0.1067 + 0.0039i  0.1942 - 0.1763i
0.2621 - 0.4131i  0.0000 - 0.0001i  0.1736 - 0.0213i -0.0001 + 0.0000i -0.0032 - 0.0008i  0.1772 - 0.2508i
0.0412 - 0.0578i  0.0023 - 0.0445i  0.0042 - 0.0487i -0.0513 + 0.1226i -0.1116 - 0.0071i  0.1943 - 0.1727i
    
```

LAM =

Columns 1 through 6

```

0.0000 - 2.3488i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 - 2.3529i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 - 0.9368i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 - 0.9532i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 - 0.9851i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 - 1.2014i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
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0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
    
```

Columns 7 through 12

```

0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 1.2505i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 - 1.3833i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 - 1.4436i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 - 1.4208i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 - 1.8942i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 1.9101i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
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0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
    
```

Columns 13 through 18

```

0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
    
```

# RCWA Benchmark Data

## 3x3 Spatial Harmonics

```
0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i  
0.0000 + 1.9857i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i  
0.0000 + 0.0000i 0.0000 + 2.0358i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i  
0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 2.0249i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i  
0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 2.3031i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i  
0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 1.8310i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i  
0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 0.0000i 0.0000 + 1.8305i
```

V =  
Columns 1 through 6

```
-0.0329 + 0.0100i 0.0058 - 0.0663i 1.4543 + 0.3556i -0.0941 - 0.1245i -0.0770 + 0.7287i -0.1657 - 0.2322i  
-0.0000 + 0.0000i -0.2841 + 0.1433i -1.1511 - 0.3358i 0.0000 + 0.0001i 0.0809 - 0.5555i -0.0000 - 0.0000i  
0.0330 - 0.0098i 0.0062 - 0.0662i 1.4522 + 0.3644i 0.0933 + 0.1248i -0.0815 + 0.7262i 0.1642 + 0.2332i  
0.0146 + 0.0000i 0.0020 + 0.6289i -0.0693 - 0.0868i 0.0196 + 0.0225i -0.2018 - 0.1996i 0.1101 - 0.1027i  
0.0000 + 0.0002i 0.0000 + 2.1552i 0.0532 + 0.0670i -0.0000 + 0.0000i 0.1993 + 0.1984i -0.0000 - 0.0000i  
-0.0146 + 0.0000i -0.0020 + 0.6289i -0.0687 - 0.0872i -0.0195 - 0.0226i -0.2006 - 0.2009i -0.1108 + 0.1020i  
-0.0330 - 0.0098i -0.0062 - 0.0662i 0.0243 + 1.4970i -0.1105 - 0.1098i 0.7278 - 0.0851i 0.2200 + 0.1815i  
0.0000 + 0.0000i 0.2841 + 0.1433i -0.0650 - 1.1974i -0.0001 - 0.0000i -0.5551 + 0.0836i -0.0000 - 0.0000i  
0.0329 + 0.0100i -0.0058 - 0.0663i 0.0152 + 1.4970i 0.1102 + 0.1106i 0.7283 - 0.0806i -0.2189 - 0.1829i  
0.0127 + 0.0804i 0.0135 - 0.0160i -1.1443 - 0.3193i 0.5201 + 0.1324i 0.1175 - 0.2092i -0.5467 + 0.0547i  
0.3103 - 0.2262i -0.0000 + 0.0000i -0.0000 + 0.0001i -0.3209 - 0.0681i 0.0000 - 0.0000i 0.3052 + 0.0084i  
0.0122 + 0.0805i 0.0136 + 0.0159i 1.1425 + 0.3259i 0.5193 + 0.1353i -0.1188 + 0.2086i -0.5469 + 0.0514i  
-0.0018 - 0.5884i -0.0380 + 0.0002i 0.5919 - 0.4723i -0.2641 + 0.2307i -0.1082 + 0.1093i 0.0453 + 0.0486i  
0.0000 - 2.1940i 0.0000 + 0.0002i -0.0001 - 0.0001i 0.1985 - 0.1724i 0.0000 + 0.0000i -0.0519 - 0.0560i  
0.0018 - 0.5884i 0.0380 + 0.0002i -0.5946 + 0.4689i -0.2654 + 0.2293i 0.1088 - 0.1087i 0.0450 + 0.0489i  
-0.0122 + 0.0805i 0.0136 + 0.0159i 0.0573 + 1.1867i -0.0613 - 0.5331i 0.2080 - 0.1198i 0.0929 - 0.5413i  
-0.3103 - 0.2262i 0.0000 + 0.0000i 0.0001 - 0.0000i 0.0225 + 0.3273i -0.0000 + 0.0000i -0.0149 + 0.3050i  
-0.0127 + 0.0804i -0.0135 - 0.0160i -0.0505 - 1.1869i -0.0583 - 0.5335i -0.2086 + 0.1185i 0.0962 - 0.5409i
```

Columns 7 through 12

```
-0.3752 + 0.0132i 0.7636 + 0.8534i -0.2078 - 0.1535i -0.0088 - 1.2765i 0.0761 + 0.1475i -0.6685 + 0.0962i  
0.2234 - 0.0085i 0.0000 - 0.0000i 0.0806 + 0.0453i -0.0000 - 0.0000i -0.0004 + 0.0001i -1.6737 + 0.3681i  
-0.3752 + 0.0108i -0.7583 - 0.8580i -0.2070 - 0.1549i 0.0009 + 1.2766i -0.0755 - 0.1479i -0.6691 + 0.0921i  
0.0231 + 0.0917i -0.3271 + 0.1127i -0.1122 - 0.0312i -0.0074 + 0.0219i 0.1789 - 0.1561i -0.1994 - 0.1581i  
-0.0163 - 0.0654i 0.0000 + 0.0000i 0.1059 + 0.0298i -0.0000 - 0.0000i -0.0000 - 0.0000i -0.0125 - 0.0100i  
0.0226 + 0.0918i 0.3278 - 0.1107i -0.1120 - 0.0320i 0.0075 - 0.0219i -0.1799 + 0.1549i -0.1984 - 0.1593i  
0.3364 - 0.1664i 0.0758 - 1.1426i -0.2574 + 0.0239i 0.7768 - 1.0130i -0.1357 - 0.0957i -0.0587 - 0.6729i  
-0.2013 + 0.0973i -0.0001 - 0.0000i 0.0924 + 0.0035i -0.0000 - 0.0000i 0.0001 - 0.0004i -0.0124 - 1.7136i  
0.3376 - 0.1642i -0.0828 + 1.1421i -0.2574 + 0.0224i -0.7830 + 1.0082i 0.1353 + 0.0962i -0.0545 - 0.6732i  
-0.1570 - 0.6055i -0.5635 - 0.4938i 0.0914 + 0.9923i 0.0422 + 0.3718i -0.4528 - 0.2783i 0.3159 - 0.0541i  
-0.0001 - 0.0000i 0.1477 + 0.1830i 0.0000 - 0.0000i -0.0519 + 0.2150i -1.1098 - 0.1591i 0.0004 + 0.0000i  
0.1534 + 0.6065i -0.5605 - 0.4971i -0.0853 - 0.9929i 0.0400 + 0.3720i -0.4513 - 0.2811i -0.3159 + 0.0523i  
0.2166 - 0.0546i 0.0503 + 0.1460i 0.0623 - 0.2235i -0.2090 - 0.0701i -0.3724 - 0.4272i 0.2353 - 0.2964i  
-0.0000 - 0.0000i -0.0416 - 0.1219i 0.0000 + 0.0000i -0.0787 - 0.0267i 0.0991 + 0.1144i -0.0000 - 0.0000i  
-0.2169 + 0.0533i 0.0494 + 0.1463i -0.0636 + 0.2231i -0.2086 - 0.0714i -0.3700 - 0.4293i -0.2368 + 0.2952i  
0.1489 + 0.6076i 0.1399 - 0.7360i -0.5914 + 0.8022i 0.2579 - 0.2710i -0.2142 - 0.4866i -0.0191 - 0.3196i  
0.0000 - 0.0000i -0.0050 + 0.2351i -0.0000 + 0.0000i 0.0895 - 0.2022i 0.0000 - 1.1212i 0.0001 + 0.0004i  
-0.1453 - 0.6084i 0.1442 - 0.7352i 0.5962 - 0.7985i 0.2596 - 0.2695i -0.2112 - 0.4877i 0.0174 + 0.3200i
```

Columns 13 through 18

```
0.0291 - 0.1596i 0.1277 - 0.0083i -0.0289 - 0.0361i 0.3531 - 0.1515i 0.0178 - 0.0677i 0.4567 - 0.5738i  
-0.0288 - 1.5105i 0.0001 - 0.0000i -0.0367 + 0.4478i 0.0000 - 0.0004i -0.0066 - 0.0048i 0.6418 - 0.4216i  
0.0302 - 0.1594i -0.1278 + 0.0075i -0.0292 - 0.0360i -0.3540 + 0.1493i -0.0330 + 0.0627i 0.4615 - 0.5699i  
0.4431 + 0.8002i 0.1341 - 0.0008i -0.3230 - 0.0011i 0.0000 - 1.3483i -0.0138 - 0.0117i -0.0053 - 0.8079i  
-0.1539 - 0.2800i 0.0000 - 0.0000i 0.0428 + 0.0001i -0.0001 + 0.0000i 0.0058 - 0.0022i 0.0019 + 0.5841i  
0.4383 + 0.8029i -0.1341 + 0.0001i -0.3230 + 0.0010i -0.0078 + 1.3483i -0.0024 + 0.0179i 0.0000 - 0.8080i  
-0.1508 - 0.0599i 0.1278 + 0.0066i -0.0294 + 0.0358i -0.3531 - 0.1513i -0.0665 - 0.0245i -0.4652 - 0.5669i  
-1.2601 - 0.8334i -0.0001 - 0.0000i -0.0338 - 0.4480i 0.0000 + 0.0004i -0.0017 + 0.0080i -0.6446 - 0.4174i  
-0.1504 - 0.0609i -0.1278 - 0.0074i -0.0291 + 0.0360i 0.3522 + 0.1535i 0.0585 + 0.0384i -0.4605 - 0.5708i  
-0.0786 + 0.1096i -0.1119 + 0.0569i -0.3512 + 0.2546i 0.0378 - 0.0154i -0.5630 - 0.3224i 0.0027 + 0.0530i  
-0.0000 + 0.0000i 0.2754 - 0.9463i -0.0001 - 0.0001i 0.2311 - 0.0723i -0.6358 - 0.7052i -0.0104 - 0.0040i  
0.0793 - 0.1091i -0.1124 + 0.0560i 0.3528 - 0.2523i 0.0375 - 0.0150i -0.5618 - 0.3254i -0.0141 - 0.0435i  
-0.3158 + 0.1749i 0.0090 + 1.3358i -0.0000 + 1.6710i -0.0071 - 0.0009i -0.3669 + 0.1410i 0.1129 + 0.0038i  
0.0000 + 0.0000i -0.0009 - 0.2638i -0.0001 + 0.0000i 0.0113 + 0.0000i 0.4198 - 0.1613i -0.0000 - 0.0053i  
0.3168 - 0.1730i -0.0000 + 1.3359i 0.0110 - 1.6709i -0.0071 + 0.0009i -0.3669 + 0.1410i -0.1129 + 0.0046i  
-0.1346 + 0.0085i 0.1128 + 0.0552i 0.3511 + 0.2546i 0.0374 + 0.0152i -0.1994 + 0.6178i 0.0138 - 0.0436i  
0.0000 + 0.0000i -0.2818 - 0.9444i -0.0001 + 0.0001i 0.2307 + 0.0736i 0.0000 + 0.9495i 0.0104 + 0.0039i  
0.1347 - 0.0077i 0.1123 + 0.0561i -0.3495 - 0.2569i 0.0377 + 0.0157i -0.2022 + 0.6164i -0.0023 + 0.0530i
```

A =

Columns 1 through 6

```
-0.0389 - 0.0176i 0.1425 - 0.0937i -0.0390 - 0.0174i 0.2451 - 0.1392i 0.5238 + 0.0000i 0.2442 - 0.1407i  
0.0083 + 0.0054i -0.0000 + 0.0000i -0.0083 - 0.0053i 0.0108 + 0.0161i -0.0001 + 0.0000i -0.0110 - 0.0160i  
0.1393 + 0.2619i -0.0000 - 0.0000i -0.1408 - 0.2610i 0.0497 - 0.1899i -0.0000 - 0.0000i -0.0486 + 0.1902i  
0.1566 - 0.4343i -0.1912 + 0.3208i 0.1542 - 0.4353i 0.0649 + 0.4459i -0.0071 + 0.0081i 0.0675 + 0.4454i  
0.1510 + 0.3576i 0.0000 + 0.0000i -0.1489 + 0.3585i -0.0289 + 0.1099i 0.0000 + 0.0000i 0.0283 - 0.1101i  
-0.3915 + 0.5290i 0.1691 - 0.2441i -0.3882 + 0.5312i -0.1007 + 0.0316i 0.0074 + 0.0068i -0.1005 + 0.0323i  
-0.6692 + 0.1343i -0.0000 - 0.0000i 0.6685 - 0.1383i -0.2167 + 0.1078i -0.0000 - 0.0000i 0.2161 - 0.1092i  
0.2517 + 0.1040i -0.0331 - 0.0983i 0.2523 + 0.1025i -0.0742 + 0.0390i 0.0126 + 0.0043i -0.0739 + 0.0394i  
-0.5808 - 0.2767i 0.0000 + 0.0000i 0.5825 + 0.2732i 0.1015 - 0.1055i 0.0000 - 0.0000i -0.1009 + 0.1062i  
-0.1523 + 0.2171i -0.1045 - 0.0345i -0.1509 + 0.2180i 0.0524 + 0.0807i 0.0033 + 0.0099i 0.0528 + 0.0804i  
0.0685 + 0.2341i -0.1732 + 0.5733i 0.0700 + 0.2338i 0.3370 + 0.0311i -0.0261 - 0.0227i 0.3372 + 0.0292i  
-0.0894 + 0.0989i 0.0001 + 0.0001i 0.0889 - 0.0994i -0.1519 + 0.0188i -0.0000 - 0.0000i 0.1518 - 0.0195i  
0.0364 - 0.0114i 0.0000 - 0.0000i -0.0364 + 0.0117i 0.1561 - 0.0756i 0.0000 + 0.0000i -0.1557 + 0.0765i  
0.0348 - 0.0521i -0.3484 + 0.2888i 0.0344 - 0.0523i 0.5603 + 0.3803i -0.1657 - 0.0006i 0.5628 + 0.3765i  
0.0479 - 0.1575i -0.0000 - 0.0000i -0.0468 + 0.1578i 0.6371 + 0.4218i 0.0000 - 0.0000i -0.6399 - 0.4176i  
0.0717 + 0.0515i 0.0136 + 0.1272i 0.0720 + 0.0509i 0.0012 - 0.0037i 0.0000 + 0.0082i 0.0021 - 0.0031i  
-0.2728 - 0.2078i -0.5195 - 0.1521i -0.2704 - 0.2078i 0.2276 - 0.1288i -0.1281 + 0.3333i 0.2276 - 0.1288i  
0.1268 + 0.1161i -0.0005 - 0.0058i -0.1255 - 0.1223i -0.0402 + 0.0544i -0.0038 - 0.0000i 0.0441 - 0.0511i
```

Columns 7 through 12

```
-0.0279 - 0.0072i 0.0456 + 0.1643i -0.0280 - 0.0071i 0.0025 - 0.0015i 0.0000 - 0.0000i -0.0025 + 0.0016i  
-0.0051 - 0.0168i -0.0000 - 0.0000i 0.0052 + 0.0168i -0.0317 - 0.0066i 0.0224 - 0.1366i -0.0318 - 0.0064i  
-0.2762 + 0.0505i 0.0000 - 0.0000i 0.2759 - 0.0521i 0.1149 + 0.3276i -0.1595 - 0.2495i 0.1169 + 0.3270i  
0.4815 + 0.3161i -0.2561 - 0.2718i 0.4835 + 0.3133i -0.4411 - 0.0404i 0.0001 - 0.0000i 0.4411 + 0.0376i  
-0.2067 - 0.1176i -0.0000 + 0.0000i 0.2075 + 0.1162i 0.4286 + 0.0730i -0.3336 + 0.2511i 0.4291 + 0.0703i  
0.3488 + 0.2818i -0.2477 - 0.1639i 0.3506 + 0.2798i 0.1682 - 0.1715i 0.0000 - 0.0000i -0.1671 + 0.1724i  
0.3318 - 0.2255i -0.0000 + 0.0001i -0.3303 + 0.2274i 0.1629 - 0.0141i 0.0950 - 0.1895i 0.1630 - 0.0152i
```

# RCWA Benchmark Data 3x3 Spatial Harmonics

0.2851 - 0.1771i	-0.0886 - 0.0539i	0.2840 - 0.1788i	0.3556 + 0.2685i	-0.0000 + 0.0000i	-0.3572 - 0.2663i
-0.5181 + 0.1058i	-0.0000 - 0.0000i	0.5175 - 0.1090i	-0.0766 + 0.1681i	0.0424 + 0.0750i	-0.0756 + 0.1685i
-0.0233 - 0.2993i	0.1090 + 0.0152i	-0.0251 - 0.2992i	-0.5513 - 0.0916i	-0.0000 - 0.0000i	0.5519 + 0.0882i
0.2299 + 0.1713i	0.5429 + 0.2528i	0.2309 + 0.1699i	0.1611 - 0.0112i	-0.0001 - 0.0002i	-0.1610 + 0.0121i
-0.1040 - 0.0778i	0.0001 - 0.0000i	0.1046 + 0.0772i	-0.0375 + 0.2276i	-0.3550 + 0.5258i	-0.0361 + 0.2278i
0.0163 - 0.0688i	0.0000 + 0.0000i	-0.0159 - 0.0689i	0.0728 + 0.0022i	0.5931 + 0.2291i	0.0728 - 0.0017i
0.0125 + 0.0425i	-0.4493 + 0.0536i	0.0128 + 0.0423i	0.0170 - 0.0422i	0.0000 - 0.0001i	-0.0168 + 0.0423i
0.1464 + 0.1103i	0.0000 - 0.0001i	-0.1470 - 0.1094i	0.0756 + 0.0544i	-0.1804 - 0.0610i	0.0759 + 0.0542i
0.0864 - 0.0150i	0.0842 + 0.0963i	0.0865 - 0.0154i	0.0289 - 0.1907i	0.0002 + 0.0001i	-0.0278 + 0.1908i
0.2946 - 0.2315i	0.4876 - 0.2349i	0.2914 - 0.2360i	0.1685 - 0.0940i	0.0009 + 0.0045i	-0.1637 + 0.1020i
0.0854 - 0.1085i	0.0042 + 0.0040i	-0.0779 + 0.1131i	0.2179 - 0.2690i	0.3300 - 0.2056i	0.2130 - 0.2729i

Columns 13 through 18

-0.0014 + 0.0061i	0.0001 + 0.0000i	0.0014 - 0.0061i	-0.0057 - 0.0259i	0.0000 + 0.0000i	0.0059 + 0.0258i
0.2649 + 0.0632i	0.5223 + 0.0000i	0.2653 + 0.0615i	-0.0241 - 0.0116i	0.0984 + 0.1029i	-0.0242 - 0.0115i
-0.0109 - 0.0286i	-0.0011 - 0.0009i	-0.0110 - 0.0285i	0.3645 - 0.0279i	-0.2882 + 0.0677i	0.3644 - 0.0301i
0.0092 + 0.0273i	0.0000 + 0.0000i	-0.0094 - 0.0272i	-0.0845 + 0.2468i	-0.0001 - 0.0001i	0.0831 - 0.2470i
-0.0549 - 0.1998i	-0.0019 - 0.0019i	-0.0561 - 0.1995i	-0.1765 + 0.4969i	-0.1463 - 0.3742i	-0.1735 + 0.4980i
-0.1203 + 0.0493i	-0.0000 - 0.0000i	0.1200 - 0.0500i	0.1254 + 0.5248i	0.0000 - 0.0000i	-0.1286 - 0.5241i
-0.0719 + 0.0123i	0.0830 + 0.0207i	-0.0718 + 0.0127i	0.0979 - 0.5645i	-0.1323 + 0.0721i	0.0944 - 0.5651i
0.0906 - 0.1049i	0.0000 + 0.0000i	-0.0899 + 0.1055i	-0.4043 + 0.0639i	-0.0000 - 0.0000i	0.4040 - 0.0664i
0.0064 - 0.0675i	0.0050 + 0.0177i	0.0060 - 0.0675i	-0.1264 - 0.3841i	0.0007 + 0.0144i	-0.1288 - 0.3832i
0.0105 + 0.0005i	0.0000 + 0.0000i	-0.0105 - 0.0004i	-0.4718 + 0.2511i	-0.0000 - 0.0000i	0.4702 - 0.2541i
-0.1009 + 0.0646i	-0.0000 - 0.0000i	0.1005 - 0.0652i	-0.0818 + 0.0296i	-0.0002 + 0.0001i	0.0814 - 0.0301i
0.0745 + 0.0530i	0.0052 + 0.0066i	0.0748 + 0.0525i	0.2344 + 0.0251i	0.5915 + 0.2380i	0.2345 + 0.0237i
-0.3627 - 0.0865i	0.1653 + 0.0909i	-0.3632 - 0.0843i	0.0066 + 0.0578i	0.1433 + 0.6115i	0.0070 + 0.0578i
-0.0150 - 0.0566i	0.0000 + 0.0000i	0.0153 + 0.0565i	0.0109 - 0.0653i	-0.0000 + 0.0001i	-0.0105 + 0.0654i
0.0341 + 0.1230i	-0.0001 - 0.0244i	0.0340 + 0.1230i	0.0482 - 0.0322i	0.1616 + 0.0879i	0.0478 - 0.0327i
0.6532 - 0.1780i	0.0000 + 0.0000i	-0.6522 + 0.1818i	0.1177 + 0.1515i	-0.0002 - 0.0001i	-0.1188 - 0.1508i
0.0081 + 0.0053i	0.0018 - 0.0046i	-0.0088 + 0.0040i	-0.0282 - 0.1170i	-0.0046 - 0.0009i	0.0228 + 0.1225i
0.3791 - 0.1119i	-0.4230 - 0.0014i	0.3783 - 0.1144i	0.3197 + 0.1614i	0.0623 + 0.3959i	0.3185 + 0.1608i

B =

Columns 1 through 6

-0.0280 + 0.0071i	0.0456 - 0.1643i	-0.0279 + 0.0072i	0.2442 + 0.1407i	1.3005 + 0.0000i	0.2451 + 0.1392i
0.0052 - 0.0168i	-0.0000 + 0.0000i	-0.0051 + 0.0168i	-0.0110 + 0.0160i	-0.0001 + 0.0000i	0.0108 - 0.0161i
0.0121 + 0.2805i	-0.0000 + 0.0000i	-0.0137 - 0.2805i	0.1741 - 0.0906i	0.0000 + 0.0000i	-0.1736 + 0.0916i
-0.3778 - 0.4349i	0.3050 + 0.2155i	-0.3803 - 0.4326i	-0.4505 - 0.0045i	0.2952 - 0.3399i	-0.4506 - 0.0019i
0.1152 + 0.2080i	0.0000 - 0.0000i	-0.1166 - 0.2072i	-0.1102 + 0.0278i	-0.0000 - 0.0000i	0.1101 - 0.0284i
0.3057 + 0.3283i	-0.1823 - 0.2345i	0.3076 + 0.3264i	0.0246 - 0.1027i	0.0805 + 0.0746i	0.0238 - 0.1028i
-0.1851 - 0.3557i	0.0000 - 0.0001i	0.1873 + 0.3547i	0.1397 + 0.1978i	0.0000 + 0.0000i	-0.1409 - 0.1969i
0.1156 + 0.3151i	-0.1031 - 0.0115i	0.1175 + 0.3144i	-0.0344 - 0.0764i	0.0781 + 0.0267i	-0.0349 - 0.0762i
-0.4982 + 0.1774i	0.0000 - 0.0000i	0.4971 - 0.1804i	0.1415 + 0.0378i	-0.0000 - 0.0000i	-0.1417 - 0.0370i
-0.1620 - 0.2528i	-0.0772 + 0.0783i	-0.1635 - 0.2518i	0.0069 + 0.0960i	0.0192 + 0.0567i	0.0075 + 0.0959i
0.2010 + 0.2044i	0.3273 + 0.5016i	0.2022 + 0.2033i	0.0767 + 0.3296i	-0.0846 - 0.0733i	0.0786 + 0.3292i
0.0521 + 0.1191i	-0.0001 + 0.0001i	-0.0528 - 0.1187i	-0.0527 + 0.1436i	-0.0000 - 0.0000i	0.0520 - 0.1439i
0.0497 - 0.0503i	0.0000 + 0.0000i	-0.0493 + 0.0506i	-0.0188 - 0.1724i	0.0000 + 0.0000i	0.0198 + 0.1723i
0.0131 - 0.0423i	-0.4490 - 0.0567i	0.0128 - 0.0424i	0.5654 - 0.3727i	-0.0565 - 0.0002i	0.5628 - 0.3765i
0.1462 - 0.1103i	-0.0000 - 0.0001i	-0.1456 + 0.1112i	0.6371 - 0.4218i	0.0000 - 0.0000i	-0.6343 + 0.4260i
-0.0866 - 0.0149i	-0.0837 + 0.0967i	-0.0865 - 0.0145i	-0.0022 - 0.0031i	0.0000 + 0.0028i	-0.0013 - 0.0037i
-0.0584 - 0.3704i	-0.2049 - 0.5010i	-0.0638 - 0.3692i	-0.0828 - 0.2481i	-0.0376 + 0.0978i	-0.0828 - 0.2480i
-0.0772 - 0.1136i	0.0042 - 0.0040i	0.0847 + 0.1090i	0.0438 + 0.0514i	-0.0011 - 0.0000i	-0.0398 - 0.0546i

Columns 7 through 12

-0.0390 + 0.0174i	0.1425 + 0.0937i	-0.0389 + 0.0176i	0.0059 - 0.0258i	0.0000 - 0.0000i	-0.0057 + 0.0259i
-0.0083 + 0.0053i	-0.0000 - 0.0000i	0.0083 - 0.0054i	-0.0242 + 0.0115i	0.0984 - 0.1029i	-0.0241 + 0.0116i
-0.2862 - 0.0777i	-0.0000 - 0.0000i	0.2867 + 0.0760i	0.0536 + 0.3617i	0.0004 - 0.2961i	0.0558 + 0.3613i
0.4094 - 0.2136i	-0.2909 + 0.2342i	0.4081 - 0.2158i	0.2330 - 0.1169i	0.0001 + 0.0000i	-0.2326 + 0.1182i
0.3592 - 0.1472i	0.0000 + 0.0000i	-0.3583 + 0.1493i	0.4988 - 0.1710i	-0.3735 - 0.1481i	0.4978 - 0.1741i
0.5001 - 0.4275i	-0.2306 + 0.1872i	0.4976 - 0.4307i	-0.5324 - 0.0884i	-0.0000 + 0.0000i	0.5328 + 0.0851i
0.5255 + 0.4356i	-0.0001 + 0.0000i	-0.5281 - 0.4324i	-0.1816 + 0.5434i	-0.0831 - 0.1257i	-0.1782 + 0.5445i
0.2623 + 0.0730i	-0.0863 + 0.0576i	0.2628 + 0.0715i	0.2791 + 0.2995i	-0.0000 + 0.0000i	-0.2809 - 0.2977i
-0.3541 + 0.5372i	-0.0000 + 0.0000i	0.3507 - 0.5393i	-0.0903 - 0.3940i	0.0069 + 0.0126i	-0.0928 - 0.3936i
0.2524 + 0.0813i	0.0620 - 0.0909i	0.2529 + 0.0797i	-0.5278 + 0.0842i	0.0000 - 0.0000i	0.5272 - 0.0874i
0.2414 + 0.0362i	0.5429 - 0.2528i	0.2415 + 0.0346i	-0.0182 + 0.0849i	0.0001 - 0.0002i	0.0177 - 0.0852i
-0.1166 + 0.0646i	0.0001 + 0.0001i	0.1163 - 0.0652i	-0.0289 + 0.2339i	0.1009 + 0.6295i	-0.0275 + 0.2341i
-0.0096 - 0.0370i	-0.0000 + 0.0000i	0.0099 + 0.0369i	0.0525 - 0.0251i	0.5931 - 0.2065i	0.0524 - 0.0254i
0.0340 + 0.0525i	-0.3465 - 0.2911i	0.0345 + 0.0523i	-0.0100 - 0.0655i	-0.0000 - 0.0001i	0.0105 + 0.0654i
0.0478 + 0.1575i	0.0000 - 0.0000i	-0.0489 - 0.1571i	-0.0481 - 0.0324i	-0.1610 + 0.0890i	-0.0484 - 0.0319i
-0.0717 + 0.0513i	0.0129 + 0.1273i	-0.0714 + 0.0519i	0.1179 - 0.1514i	0.0002 - 0.0001i	-0.1169 + 0.1522i
0.3400 + 0.0267i	0.4876 + 0.2349i	0.3417 + 0.0283i	-0.0989 + 0.0757i	0.0040 + 0.0024i	0.0993 - 0.0680i
-0.1263 + 0.1214i	-0.0005 + 0.0058i	0.1276 - 0.1152i	0.3195 - 0.1588i	0.0648 - 0.3955i	0.3207 - 0.1593i

Columns 13 through 18

0.0014 + 0.0061i	0.0001 + 0.0000i	-0.0014 - 0.0061i	-0.0025 - 0.0016i	0.0000 + 0.0000i	0.0025 + 0.0015i
0.2653 - 0.0615i	1.2944 + 0.0000i	0.2649 - 0.0632i	-0.0318 + 0.0064i	0.0224 + 0.1366i	-0.0317 + 0.0066i
-0.0303 - 0.0043i	0.0328 + 0.0260i	-0.0303 - 0.0041i	0.3450 + 0.0394i	-0.2793 - 0.0986i	0.3451 + 0.0373i
0.0283 + 0.0055i	0.0000 - 0.0000i	-0.0283 - 0.0053i	-0.0990 - 0.4315i	0.0000 - 0.0001i	0.1017 + 0.4311i
-0.1992 - 0.0571i	0.2544 + 0.2557i	-0.1995 - 0.0559i	0.0682 + 0.4294i	0.2528 - 0.3323i	0.0709 + 0.4290i
-0.0407 + 0.1234i	-0.0000 - 0.0000i	0.0400 - 0.1237i	0.1592 - 0.1797i	-0.0000 + 0.0000i	-0.1582 + 0.1808i
-0.0575 - 0.0449i	0.0092 + 0.0023i	-0.0577 - 0.0446i	0.1368 + 0.0898i	-0.0049 + 0.2120i	0.1373 + 0.0888i
-0.0067 - 0.1384i	0.0000 + 0.0000i	0.0076 + 0.1384i	-0.4455 - 0.0075i	0.0000 - 0.0000i	0.4455 + 0.0048i
-0.0403 - 0.0545i	0.0275 + 0.0974i	-0.0407 - 0.0542i	0.1525 + 0.1042i	0.0030 + 0.0861i	0.1531 + 0.1033i
0.0080 - 0.0067i	-0.0000 - 0.0000i	-0.0080 + 0.0068i	-0.3846 + 0.4055i	-0.0000 - 0.0000i	0.3821 - 0.4079i
-0.0503 + 0.1087i	-0.0000 - 0.0000i	0.0496 - 0.1090i	-0.0109 - 0.1611i	-0.0002 - 0.0000i	0.0118 + 0.1611i
0.0346 + 0.0846i	0.0016 + 0.0021i	0.0352 + 0.0844i	0.2301 + 0.0154i	0.5915 - 0.2295i	0.2302 + 0.0139i
-0.2657 - 0.2616i	0.0546 + 0.0300i	-0.2673 - 0.2600i	0.0405 + 0.0606i	0.5112 + 0.3781i	0.0409 + 0.0603i
0.0157 - 0.0564i	0.0000 + 0.0000i	-0.0154 + 0.0565i	-0.0165 - 0.0424i	0.0000 + 0.0001i	0.0167 + 0.0423i
-0.0332 + 0.1233i	-0.0000 - 0.0008i	-0.0333 + 0.1233i	-0.0755 + 0.0547i	0.1800 - 0.0622i	-0.0753 + 0.0549i
0.6532 - 0.1780i	0.0000 + 0.0000i	-0.6542 - 0.1742i	0.0289 + 0.1906i	-0.0002 + 0.0001i	-0.0300 - 0.1905i
0.0039 + 0.0089i	0.0005 - 0.0014i	-0.0096 - 0.0016i	0.0533 + 0.1854i	-0.0036 + 0.0027i	-0.0622 - 0.1826i
0.3776 + 0.1168i	-0.1241 - 0.0004i	0.3783 + 0.1144i	0.2112 + 0.2743i	0.3286 + 0.2077i	0.2161 + 0.2704i

X =

Columns 1 through 6

-0.8536 - 0.5209i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	-0.8502 - 0.5264i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0991 + 0.9951i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i

# RCWA Benchmark Data

## 3x3 Spatial Harmonics



0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0734 + 0.9973i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0234 + 0.9997i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.3110 + 0.9504i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i

Columns 7 through 12

0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
-0.3833 - 0.9236i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	-0.5663 + 0.8242i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	-0.6417 + 0.7669i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.6139 + 0.7894i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.9862 + 0.1654i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.9900 - 0.1408i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i

Columns 13 through 18

0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
-0.9997 - 0.0225i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	-0.9984 + 0.0562i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	-0.9992 + 0.0391i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.9989 + 0.0473i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.9650 - 0.2623i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.9648 - 0.2632i

S.S11 =

Columns 1 through 6

-2.4434 - 0.3726i	0.8430 + 0.1689i	-0.7677 - 0.3002i	-0.1820 - 0.6354i	0.3515 - 0.2505i	-0.2822 - 0.4310i
0.8570 + 0.3715i	-0.7977 - 0.2186i	0.8594 + 0.3663i	0.1209 + 0.5365i	-0.2899 + 0.2343i	0.1241 + 0.5358i
-0.7640 - 0.3095i	0.8420 + 0.1741i	-2.4435 - 0.3727i	-0.2770 - 0.4345i	0.3530 - 0.2484i	-0.1820 - 0.6354i
0.5134 - 0.2141i	-0.2438 + 0.1135i	0.4415 + 0.0239i	0.4166 + 0.1905i	-0.1599 + 0.3389i	0.3041 + 0.1829i
-0.5708 + 0.2056i	0.2117 - 0.2680i	-0.5696 + 0.2091i	-0.6108 - 0.2928i	-0.1497 - 0.6911i	-0.6126 - 0.2890i
0.4411 + 0.0293i	-0.2445 + 0.1120i	0.5135 - 0.2141i	0.3019 + 0.1865i	-0.1620 + 0.3380i	0.4166 + 0.1905i
-0.1897 + 0.2308i	0.1406 - 0.3110i	-0.6622 + 0.3339i	-0.5731 + 0.2380i	-0.2721 - 0.4056i	-0.6284 + 0.0255i
0.1957 - 0.3990i	0.0170 + 0.3584i	0.1934 - 0.4003i	0.5011 - 0.2295i	0.3038 + 0.2400i	0.4997 - 0.2325i
-0.6660 + 0.3254i	0.1424 - 0.3101i	-0.1897 + 0.2309i	-0.6285 + 0.0179i	-0.2696 - 0.4072i	-0.5731 + 0.2380i
0.8708 + 0.2371i	-0.4028 - 0.0713i	0.1441 + 0.1219i	0.3632 + 0.5490i	-0.2832 + 0.2253i	0.2614 + 0.2693i
-0.0739 - 0.0500i	-0.0000 + 0.0000i	0.0743 + 0.0496i	0.0071 - 0.0629i	0.0000 + 0.0000i	-0.0067 + 0.0630i
-0.1426 - 0.1236i	0.4024 + 0.0738i	-0.8709 - 0.2372i	-0.2582 - 0.2726i	0.2846 - 0.2236i	-0.3632 - 0.5491i
-0.4819 + 0.5047i	0.0163 - 0.1377i	0.2400 + 0.3106i	-0.0311 + 0.0263i	-0.0726 - 0.0031i	-0.0593 + 0.1730i
0.2224 - 0.0994i	0.0000 - 0.0000i	-0.2219 + 0.1008i	-0.0003 + 0.0694i	0.0000 - 0.0000i	-0.0001 - 0.0694i
-0.2360 - 0.3135i	-0.0172 + 0.1376i	0.4820 - 0.5048i	0.0615 - 0.1722i	0.0726 + 0.0036i	0.0311 - 0.0263i
-0.1142 + 0.1304i	0.0898 - 0.1757i	-0.4933 + 0.2009i	-0.5866 + 0.2452i	-0.0592 - 0.3326i	-0.4352 - 0.0540i
-0.0988 + 0.0851i	-0.0000 + 0.0000i	0.0983 - 0.0858i	0.0075 - 0.0734i	-0.0000 + 0.0000i	-0.0071 + 0.0734i
0.4955 - 0.1946i	-0.0909 + 0.1751i	0.1142 - 0.1303i	0.4344 + 0.0593i	0.0572 + 0.3329i	0.5865 - 0.2451i

Columns 7 through 12

0.3582 - 0.2926i	-0.2977 + 0.3062i	-0.0070 - 0.5214i	1.0350 + 0.3456i	0.3523 - 0.0053i	-0.5884 - 0.2823i
-0.3838 + 0.4216i	0.4459 - 0.2751i	-0.3812 + 0.4238i	-0.9888 - 0.3586i	0.0000 + 0.0000i	0.9910 + 0.3526i
-0.0007 - 0.5218i	-0.2995 + 0.3044i	0.3582 - 0.2926i	0.5849 + 0.2894i	-0.3523 + 0.0030i	-1.0351 - 0.3456i
0.2664 + 0.5101i	-0.0606 - 0.2614i	0.2368 + 0.2858i	-0.4035 + 0.1678i	-0.0044 + 0.0461i	0.4180 - 0.0086i
-0.3699 - 0.4906i	0.2066 + 0.2557i	-0.3728 - 0.4883i	0.5005 - 0.2967i	-0.0000 - 0.0000i	-0.4987 + 0.2998i
0.2334 + 0.2887i	-0.0590 - 0.2618i	0.2664 + 0.5101i	-0.4180 + 0.0035i	0.0047 + 0.0460i	0.4036 - 0.1678i
-2.4835 - 0.3264i	0.7619 + 0.2597i	-0.8237 - 0.2201i	0.0131 - 0.4160i	-0.0650 + 0.0375i	-0.4453 + 0.3447i
0.9960 + 0.1947i	-0.7977 - 0.2186i	0.9971 + 0.1886i	-0.1923 + 0.4132i	0.0000 - 0.0000i	0.1899 - 0.4145i
-0.8210 - 0.2302i	0.7603 + 0.2644i	-2.4834 - 0.3263i	0.4493 - 0.3389i	0.0652 - 0.0371i	-0.0131 + 0.4160i
-0.1734 + 0.1998i	0.1666 - 0.1978i	0.0477 + 0.3989i	-2.1259 - 0.2023i	0.0841 - 0.0153i	0.5466 + 0.1087i
0.0420 + 0.1235i	-0.0000 - 0.0000i	-0.0427 - 0.1232i	0.2965 + 0.0526i	0.2856 + 0.0277i	0.2969 + 0.0507i
-0.0429 - 0.3998i	-0.1678 + 0.1969i	0.1734 - 0.1998i	0.5453 + 0.1154i	0.0842 - 0.0148i	-2.1260 - 0.2024i
0.3367 + 0.5490i	0.0339 - 0.0761i	-0.2633 + 0.1407i	0.2386 - 0.1902i	-0.0058 + 0.0158i	0.1526 + 0.1539i
-0.2604 - 0.0885i	0.0000 + 0.0000i	0.2609 + 0.0869i	-0.2026 + 0.0625i	-0.2171 + 0.1116i	-0.2022 + 0.0638i
0.2651 - 0.1374i	-0.0343 + 0.0758i	-0.3367 - 0.5489i	0.1506 + 0.1558i	-0.0059 + 0.0158i	0.2387 - 0.1902i
-0.8505 - 0.2608i	0.3291 + 0.1735i	-0.1155 - 0.1628i	0.2059 - 0.0447i	-0.0725 + 0.0730i	-0.5340 + 0.1983i
0.0890 + 0.0123i	-0.0000 - 0.0000i	-0.0891 - 0.0118i	0.0743 - 0.0481i	-0.0081 - 0.0490i	0.0741 - 0.0486i
0.1135 + 0.1642i	-0.3280 - 0.1754i	0.8504 + 0.2608i	-0.5362 + 0.1915i	-0.0729 + 0.0725i	0.2059 - 0.0446i

Columns 13 through 18

RCWA Benchmark Data  
3x3 Spatial Harmonics

```
-0.0399 - 0.0471i -0.0695 + 0.1332i -0.0957 - 0.0066i 0.5546 - 0.4646i 0.0262 + 0.0591i -0.1948 + 0.4898i
-0.0215 + 0.0476i -0.0000 + 0.0000i 0.0212 - 0.0477i -0.3988 + 0.4117i 0.0000 + 0.0000i 0.3963 - 0.4141i
0.0956 + 0.0078i 0.0703 - 0.1327i 0.0400 + 0.0471i 0.2007 - 0.4877i -0.0259 - 0.0593i -0.5546 + 0.4646i
-0.0095 + 0.0080i -0.0384 + 0.0001i 0.0181 - 0.0530i 0.1489 + 0.4355i -0.0042 + 0.0395i -0.1955 - 0.2833i
0.0020 - 0.0402i 0.0000 - 0.0000i -0.0017 + 0.0402i -0.3096 - 0.4330i -0.0000 + 0.0000i 0.3122 + 0.4311i
-0.0188 + 0.0527i 0.0384 + 0.0002i 0.0095 - 0.0081i 0.1921 + 0.2858i 0.0045 - 0.0395i -0.1489 - 0.4355i
0.0829 - 0.0519i -0.0459 - 0.1664i 0.0610 + 0.0535i -1.0432 - 0.3363i -0.3375 - 0.0488i 0.5996 + 0.2662i
-0.0108 + 0.0863i 0.0000 + 0.0000i 0.0102 - 0.0864i 1.1046 + 0.2261i 0.0000 - 0.0000i -1.1059 - 0.2193i
-0.0603 + 0.0542i 0.0449 + 0.1666i -0.0828 + 0.0519i -0.5964 - 0.2735i 0.3371 + 0.0509i 1.0431 + 0.3363i
0.1561 + 0.2637i 0.0468 - 0.1792i 0.0892 - 0.0771i -0.1100 + 0.0955i -0.0325 - 0.1022i -0.1160 - 0.3515i
-0.0118 - 0.0037i -0.1524 + 0.0367i -0.0118 - 0.0036i 0.0301 + 0.0743i -0.0537 + 0.0423i 0.0305 + 0.0741i
0.0901 - 0.0760i 0.0479 - 0.1789i 0.1561 + 0.2637i -0.1118 - 0.3532i -0.0319 - 0.1024i -0.1100 + 0.0956i
-0.1911 - 0.0785i 0.2552 + 0.0100i -0.2042 + 0.0681i 0.1361 + 0.1909i 0.0243 + 0.0074i 0.2167 - 0.0170i
0.0064 - 0.1412i -0.2936 + 0.5112i 0.0055 - 0.1412i -0.1781 - 0.0844i -0.0416 - 0.1728i -0.1786 - 0.0833i
-0.2034 - 0.0705i 0.2552 + 0.0116i -0.1911 - 0.0785i 0.2169 - 0.0143i 0.0243 + 0.0076i 0.1360 + 0.1908i
0.2104 - 0.2381i -0.0721 - 0.1253i 0.0946 + 0.1355i -2.0860 - 0.2487i 0.0925 - 0.0284i 0.4906 + 0.1888i
0.0029 - 0.0077i 0.0984 + 0.1915i 0.0028 - 0.0077i 0.3122 - 0.0000i 0.2856 + 0.0277i 0.3122 - 0.0020i
0.0929 + 0.1367i -0.0713 - 0.1257i 0.2103 - 0.2381i 0.4882 + 0.1948i 0.0927 - 0.0278i -2.0859 - 0.2486i
```

S.S12 =  
Columns 1 through 6

```
-1.8592 - 0.3625i 0.5795 + 0.1520i -0.5202 - 0.2952i -0.5053 - 0.9160i 0.5012 - 0.2921i -0.2891 - 0.4538i
0.8276 + 0.3710i -1.4062 - 0.1763i 0.8299 + 0.3660i 0.2393 + 0.6240i -0.5823 + 0.1328i 0.2432 + 0.6226i
-0.5166 - 0.3015i 0.5786 + 0.1556i -1.8594 - 0.3626i -0.2837 - 0.4573i 0.5030 - 0.2891i -0.5053 - 0.9160i
0.4698 - 0.1917i -0.3354 + 0.1257i 0.4479 + 0.0658i -0.5398 + 0.1654i -0.0139 + 0.2587i 0.2840 + 0.1579i
-0.5747 + 0.2157i 0.4770 - 0.2036i -0.5734 + 0.2192i -0.4674 - 0.0279i -0.6911 + 0.1497i -0.4676 - 0.0251i
0.4470 + 0.0713i -0.3362 + 0.1236i 0.4698 - 0.1917i 0.2820 + 0.1614i -0.0154 + 0.2586i -0.5398 + 0.1654i
-0.0927 + 0.3388i 0.0639 - 0.3182i -0.5496 + 0.3451i -0.9073 + 0.4734i -0.1567 - 0.5097i -0.6459 + 0.0026i
0.2380 - 0.3820i 0.0477 + 0.3141i 0.2358 - 0.3836i 0.6890 - 0.2534i 0.2308 + 0.5408i 0.6874 - 0.2576i
-0.5535 + 0.3380i 0.0658 - 0.3177i -0.0928 + 0.3388i -0.6458 - 0.0053i -0.1536 - 0.5106i -0.9072 + 0.4733i
1.9723 + 0.2394i -0.5154 - 0.0800i 0.4977 + 0.1258i 0.1215 + 0.3660i -0.2047 + 0.1940i 0.2652 + 0.1834i
-0.4804 - 0.0642i -0.0000 + 0.0000i 0.4808 + 0.0612i 0.0466 - 0.0120i -0.0000 + 0.0000i -0.0465 + 0.0123i
-0.4962 - 0.1319i 0.5150 + 0.0832i -1.9725 - 0.2395i -0.2631 - 0.1867i 0.2059 - 0.1928i -0.1215 - 0.3661i
-0.1842 + 0.1279i 0.0048 - 0.0796i 0.1612 + 0.1065i -0.0413 + 0.0735i -0.0961 - 0.0459i -0.0635 + 0.2135i
0.2991 - 0.0917i 0.0000 - 0.0000i -0.2986 + 0.0936i -0.0080 + 0.0743i 0.0000 - 0.0000i 0.0075 - 0.0744i
-0.1598 - 0.1084i -0.0053 + 0.0796i 0.1843 - 0.1279i 0.0662 - 0.2127i 0.0958 + 0.0465i 0.0414 - 0.0734i
-0.2202 - 0.0217i 0.1644 - 0.1581i -0.6228 + 0.1917i -0.3413 + 0.0867i -0.1277 - 0.2831i -0.4373 - 0.1139i
-0.0868 + 0.0661i -0.0000 + 0.0000i 0.0864 - 0.0667i -0.0318 - 0.0243i -0.0000 + 0.0000i 0.0320 + 0.0241i
0.6249 - 0.1838i -0.1653 + 0.1570i 0.2202 + 0.0217i 0.4357 + 0.1193i 0.1260 + 0.2838i 0.3413 - 0.0867i
```

Columns 7 through 12

```
0.4519 - 0.4035i -0.3372 + 0.2932i 0.1066 - 0.5338i 2.1447 + 0.3315i -0.0334 + 0.0092i -0.8287 - 0.2687i
-0.3413 + 0.4083i 0.2972 - 0.2389i -0.3388 + 0.4102i -0.7258 - 0.3391i 0.0000 + 0.0000i 0.7279 + 0.3347i
0.1131 - 0.5328i -0.3390 + 0.2912i 0.4519 - 0.4034i 0.8254 + 0.2787i 0.0335 - 0.0090i -2.1448 - 0.3316i
0.2216 + 0.4869i -0.1186 - 0.3038i 0.2411 + 0.2424i -0.5699 + 0.2866i 0.0200 + 0.0151i 0.4286 + 0.0119i
-0.3593 - 0.4884i 0.1171 + 0.5136i -0.3622 - 0.4861i 0.5992 - 0.1888i -0.0000 - 0.0000i -0.5981 + 0.1925i
0.2382 + 0.2454i -0.1168 - 0.3045i 0.2216 + 0.4868i -0.4283 - 0.0171i -0.0199 - 0.0152i 0.5699 - 0.2866i
-1.9019 - 0.3398i 0.5224 + 0.2432i -0.5768 - 0.2264i 0.1594 - 0.2784i -0.0783 + 0.0469i -0.5385 + 0.3685i
0.9699 + 0.1946i -1.4062 - 0.1763i 0.9710 + 0.1887i -0.1185 + 0.4180i 0.0000 - 0.0000i 0.1160 - 0.4188i
-0.5741 - 0.2334i 0.5209 + 0.2463i -1.9017 - 0.3398i 0.5428 - 0.3617i 0.0785 - 0.0464i -0.1594 + 0.2784i
-0.0746 + 0.0450i 0.1110 - 0.1931i 0.1831 + 0.3894i -1.1989 - 0.2210i -0.5551 - 0.0066i 0.2480 + 0.1216i
0.0187 + 0.0964i -0.0000 - 0.0000i -0.0192 - 0.0962i 0.0559 + 0.0373i -0.9594 + 0.0089i 0.0562 + 0.0369i
-0.1784 - 0.3920i -0.1121 + 0.1925i 0.0746 - 0.0451i 0.2466 + 0.1246i -0.5551 - 0.0101i -1.1990 - 0.2210i
0.0768 + 0.1423i 0.0367 - 0.0279i -0.2253 - 0.0333i 0.2568 - 0.3047i 0.2562 - 0.1168i 0.1404 + 0.2345i
-0.2358 - 0.1615i 0.0000 + 0.0000i 0.2367 + 0.1600i -0.1860 + 0.0517i -0.0196 + 0.0527i -0.1857 + 0.0528i
0.2250 + 0.0362i -0.0369 + 0.0276i -0.0768 - 0.1422i 0.1374 + 0.2363i 0.2569 - 0.1152i 0.2568 - 0.3047i
-1.9508 - 0.2511i 0.4267 + 0.1816i -0.4688 - 0.1609i 0.0556 - 0.1924i -0.0529 + 0.0477i -0.3998 + 0.1955i
0.5008 + 0.0137i -0.0000 - 0.0000i -0.5009 - 0.0106i 0.0830 - 0.0521i 0.0607 - 0.0480i 0.0828 - 0.0526i
0.4668 + 0.1666i -0.4256 - 0.1842i 1.9507 + 0.2510i -0.4020 + 0.1904i -0.0531 + 0.0473i 0.0556 - 0.1923i
```

Columns 13 through 18

```
-0.0778 - 0.1626i -0.0426 + 0.1559i -0.0810 + 0.0618i 0.3981 - 0.3062i 0.0435 + 0.0745i -0.0908 + 0.4929i
-0.0232 + 0.0173i -0.0000 + 0.0000i 0.0230 - 0.0175i -0.4327 + 0.3948i 0.0000 + 0.0000i 0.4303 - 0.3973i
0.0818 - 0.0608i 0.0436 - 0.1556i 0.0778 + 0.1626i 0.0968 - 0.4921i -0.0431 - 0.0748i -0.3981 + 0.3061i
-0.0127 + 0.0225i -0.0412 - 0.0042i 0.0194 - 0.0654i 0.3094 + 0.5779i -0.0292 + 0.0077i -0.2000 - 0.2865i
0.0257 - 0.0530i 0.0000 - 0.0000i -0.0254 + 0.0532i -0.3460 - 0.5747i -0.0000 - 0.0000i 0.3495 + 0.5725i
-0.0203 + 0.0651i 0.0411 + 0.0044i 0.0126 - 0.0225i 0.1965 + 0.2890i 0.0292 - 0.0075i -0.3093 - 0.5779i
0.1284 - 0.1630i -0.0359 - 0.1327i 0.0631 + 0.1245i -2.1534 - 0.3270i 0.0483 - 0.0295i 0.8401 + 0.2549i
-0.0033 + 0.0499i 0.0000 + 0.0000i 0.0030 - 0.0499i 0.8164 + 0.2062i 0.0000 - 0.0000i -0.8176 - 0.2012i
-0.0615 - 0.1253i 0.0351 + 0.1329i -0.1283 + 0.1629i -0.8369 - 0.2651i -0.0485 + 0.0292i 2.1533 + 0.3269i
0.0005 - 0.0085i 0.1298 - 0.1447i 0.0767 + 0.0490i -0.2637 + 0.2562i 0.0016 - 0.0653i 0.0235 - 0.3604i
-0.0786 - 0.0862i -0.0144 + 0.1550i -0.0791 - 0.0857i 0.0397 + 0.0818i 0.0353 + 0.0728i 0.0402 + 0.0815i
0.0762 + 0.0500i 0.1307 - 0.1439i 0.0005 - 0.0085i 0.0279 - 0.3603i 0.0019 - 0.0654i -0.2637 + 0.2563i
-1.0460 + 0.0328i -0.2741 + 0.3561i 0.1185 + 0.0399i 0.1486 + 0.3071i 0.1621 + 0.1756i 0.1840 - 0.0991i
0.1961 + 0.1529i -0.7004 + 0.4023i 0.1970 + 0.1517i -0.1948 - 0.0738i -0.1758 - 0.0163i -0.1952 - 0.0725i
0.1180 + 0.0414i -0.2763 + 0.3544i -1.0460 + 0.0328i 0.1852 - 0.0968i 0.1610 + 0.1766i 0.1486 + 0.3070i
0.0311 + 0.0161i -0.0703 - 0.2151i 0.0523 - 0.0077i -1.1565 - 0.2438i -0.5411 - 0.0507i 0.1914 + 0.1904i
-0.1254 + 0.0562i 0.0465 + 0.0173i -0.1250 + 0.0570i 0.0727 + 0.0103i -0.9594 + 0.0089i 0.0727 + 0.0098i
0.0524 - 0.0071i -0.0690 - 0.2155i 0.0311 + 0.0161i 0.1891 + 0.1927i -0.5408 - 0.0541i -1.1564 - 0.2437i
```

S.S21 =  
Columns 1 through 6

```
-1.8592 - 0.3625i 0.5795 + 0.1520i -0.5202 - 0.2952i -0.5053 - 0.9160i 0.5012 - 0.2921i -0.2891 - 0.4538i
0.8276 + 0.3710i -1.4062 - 0.1763i 0.8299 + 0.3660i 0.2393 + 0.6240i -0.5823 + 0.1328i 0.2432 + 0.6226i
-0.5166 - 0.3015i 0.5786 + 0.1556i -1.8594 - 0.3626i -0.2837 - 0.4573i 0.5030 - 0.2891i -0.5053 - 0.9160i
0.4698 - 0.1917i -0.3354 + 0.1257i 0.4479 + 0.0658i -0.5398 + 0.1654i -0.0139 + 0.2587i 0.2840 + 0.1579i
-0.5747 + 0.2157i 0.4770 - 0.2036i -0.5734 + 0.2192i -0.4674 - 0.0279i -0.6911 + 0.1497i -0.4676 - 0.0251i
0.4470 + 0.0713i -0.3362 + 0.1236i 0.4698 - 0.1917i 0.2820 + 0.1614i -0.0154 + 0.2586i -0.5398 + 0.1654i
-0.0927 + 0.3388i 0.0639 - 0.3182i -0.5496 + 0.3451i -0.9073 + 0.4734i -0.1567 - 0.5097i -0.6459 + 0.0026i
0.2380 - 0.3820i 0.0477 + 0.3141i 0.2358 - 0.3836i 0.6890 - 0.2534i 0.2308 + 0.5408i 0.6874 - 0.2576i
-0.5535 + 0.3380i 0.0658 - 0.3177i -0.0928 + 0.3388i -0.6458 - 0.0053i -0.1536 - 0.5106i -0.9072 + 0.4733i
1.9723 + 0.2394i -0.5154 - 0.0800i 0.4977 + 0.1258i 0.1215 + 0.3660i -0.2047 + 0.1940i 0.2652 + 0.1834i
-0.4804 - 0.0642i -0.0000 + 0.0000i 0.4808 + 0.0612i 0.0466 - 0.0120i -0.0000 + 0.0000i -0.0465 + 0.0123i
-0.4962 - 0.1319i 0.5150 + 0.0832i -1.9725 - 0.2395i -0.2631 - 0.1867i 0.2059 - 0.1928i -0.1215 - 0.3661i
-0.1842 + 0.1279i 0.0048 - 0.0796i 0.1612 + 0.1065i -0.0413 + 0.0735i -0.0961 - 0.0459i -0.0635 + 0.2135i
0.2991 - 0.0917i 0.0000 - 0.0000i -0.2986 + 0.0936i -0.0080 + 0.0743i 0.0000 - 0.0000i 0.0075 - 0.0744i
-0.1598 - 0.1084i -0.0053 + 0.0796i 0.1843 - 0.1279i 0.0662 - 0.2127i 0.0958 + 0.0465i 0.0414 - 0.0734i
-0.2202 - 0.0217i 0.1644 - 0.1581i -0.6228 + 0.1917i -0.3413 + 0.0867i -0.1277 - 0.2831i -0.4373 - 0.1139i
-0.0868 + 0.0661i -0.0000 + 0.0000i 0.0864 - 0.0667i -0.0318 - 0.0243i -0.0000 + 0.0000i 0.0320 + 0.0241i
```





RCWA Benchmark Data  
3x3 Spatial Harmonics

-0.2034 - 0.0705i	0.2552 + 0.0116i	-0.1911 - 0.0785i	0.2169 - 0.0143i	0.0243 + 0.0076i	0.1360 + 0.1908i
0.2104 - 0.2381i	-0.0721 - 0.1253i	0.0946 + 0.1355i	-2.0860 - 0.2487i	0.0925 - 0.0284i	0.4906 + 0.1888i
0.0029 - 0.0077i	0.0984 + 0.1915i	0.0028 - 0.0077i	0.3122 - 0.0000i	0.2856 + 0.0277i	0.3122 - 0.0020i
0.0929 + 0.1367i	-0.0713 - 0.1257i	0.2103 - 0.2381i	0.4882 + 0.1948i	0.0927 - 0.0278i	-2.0859 - 0.2486i

SG.S11 =  
Columns 1 through 6

-2.4434 - 0.3726i	0.8430 + 0.1689i	-0.7677 - 0.3002i	-0.1820 - 0.6354i	0.3515 - 0.2505i	-0.2822 - 0.4310i
0.8570 + 0.3715i	-0.7977 - 0.2186i	0.8594 + 0.3663i	0.1209 + 0.5365i	-0.2899 + 0.2343i	0.1241 + 0.5358i
-0.7640 - 0.3095i	0.8420 + 0.1741i	-2.4435 - 0.3727i	-0.2770 - 0.4345i	0.3530 - 0.2484i	-0.1820 - 0.6354i
0.5134 - 0.2141i	-0.2438 + 0.1135i	0.4415 + 0.0239i	0.4166 + 0.1905i	-0.1599 + 0.3389i	0.3041 + 0.1829i
-0.5708 + 0.2056i	0.2117 - 0.2680i	-0.5696 + 0.2091i	-0.6108 - 0.2928i	-0.1497 - 0.6911i	-0.6126 - 0.2890i
0.4411 + 0.0293i	-0.2445 + 0.1120i	0.5135 - 0.2141i	0.3019 + 0.1865i	-0.1620 + 0.3380i	0.4166 + 0.1905i
-0.1897 + 0.2308i	0.1406 - 0.3110i	-0.6622 + 0.3339i	-0.5731 + 0.2380i	-0.2721 - 0.4056i	-0.6284 + 0.0255i
0.1957 - 0.3990i	0.0170 + 0.3584i	0.1934 - 0.4003i	0.5011 - 0.2295i	0.3038 + 0.2400i	0.4997 - 0.2325i
-0.6660 + 0.3254i	0.1424 - 0.3101i	-0.1897 + 0.2309i	-0.6285 + 0.0179i	-0.2696 - 0.4072i	-0.5731 + 0.2380i
0.8708 + 0.2371i	-0.4028 - 0.0713i	0.1441 + 0.1219i	0.3632 + 0.5490i	-0.2832 + 0.2253i	0.2614 + 0.2693i
-0.0739 - 0.0500i	-0.0000 + 0.0000i	0.0743 + 0.0496i	0.0071 - 0.0629i	0.0000 + 0.0000i	-0.0067 + 0.0630i
-0.1426 - 0.1236i	0.4024 + 0.0738i	-0.8709 - 0.2372i	-0.2582 - 0.2726i	0.2846 - 0.2236i	-0.3632 - 0.5491i
-0.4819 + 0.5047i	0.0163 - 0.1377i	0.2400 + 0.3106i	-0.0311 + 0.0263i	-0.0726 - 0.0031i	-0.0593 + 0.1730i
0.2224 - 0.0994i	0.0000 - 0.0000i	-0.2219 + 0.1008i	-0.0003 + 0.0694i	0.0000 - 0.0000i	-0.0001 - 0.0694i
-0.2360 - 0.3135i	-0.0172 + 0.1376i	0.4820 - 0.5048i	0.0615 - 0.1722i	0.0726 + 0.0036i	0.0311 - 0.0263i
-0.1142 + 0.1304i	0.0898 - 0.1757i	-0.4933 + 0.2009i	-0.5866 + 0.2452i	-0.0592 - 0.3326i	-0.4352 - 0.0540i
-0.0988 + 0.0851i	-0.0000 + 0.0000i	0.0983 - 0.0858i	0.0075 - 0.0734i	-0.0000 + 0.0000i	-0.0071 + 0.0734i
0.4955 - 0.1946i	-0.0909 + 0.1751i	0.1142 - 0.1303i	0.4344 + 0.0593i	0.0572 + 0.3329i	0.5865 - 0.2451i

Columns 7 through 12

0.3582 - 0.2926i	-0.2977 + 0.3062i	-0.0070 - 0.5214i	1.0350 + 0.3456i	0.3523 - 0.0053i	-0.5884 - 0.2823i
-0.3838 + 0.4216i	0.4459 - 0.2751i	-0.3812 + 0.4238i	-0.9888 - 0.3586i	0.0000 + 0.0000i	0.9910 + 0.3526i
-0.0007 - 0.5218i	-0.2995 + 0.3044i	0.3582 - 0.2926i	0.5849 + 0.2894i	-0.3523 + 0.0030i	-1.0351 - 0.3456i
0.2664 + 0.5101i	-0.0606 - 0.2614i	0.2368 + 0.2858i	-0.4035 + 0.1678i	-0.0044 + 0.0461i	0.4180 - 0.0086i
-0.3699 - 0.4906i	0.2066 + 0.2557i	-0.3728 - 0.4883i	0.5005 - 0.2967i	-0.0000 - 0.0000i	-0.4987 + 0.2998i
0.2334 + 0.2887i	-0.0590 - 0.2618i	0.2664 + 0.5101i	-0.4180 + 0.0035i	0.0047 - 0.0460i	0.4036 - 0.1678i
-2.4835 + 0.3264i	0.7619 + 0.2597i	-0.8237 - 0.2201i	0.0131 - 0.4160i	-0.0650 + 0.0375i	-0.4453 + 0.3447i
0.9960 + 0.1947i	-0.7977 - 0.2186i	0.9971 + 0.1886i	-0.1923 + 0.4132i	0.0000 - 0.0000i	0.1899 - 0.4145i
-0.8210 - 0.2302i	0.7603 + 0.2644i	-2.4834 - 0.3263i	0.4493 - 0.3389i	0.0652 - 0.0371i	-0.0131 + 0.4160i
-0.1734 + 0.1998i	0.1666 - 0.1978i	0.0477 + 0.3989i	-2.1259 - 0.2023i	0.0841 - 0.0153i	0.5466 + 0.1087i
0.0420 + 0.1235i	-0.0000 - 0.0000i	-0.0427 - 0.1232i	0.2965 + 0.0526i	0.2856 + 0.0277i	0.2969 + 0.0507i
-0.0429 - 0.3998i	-0.1678 + 0.1969i	0.1734 - 0.1998i	0.5453 + 0.1154i	0.0842 - 0.0148i	-2.1260 - 0.2024i
0.3367 + 0.5490i	0.0339 - 0.0761i	-0.2633 + 0.1407i	0.2386 - 0.1902i	-0.0058 + 0.0158i	0.1526 + 0.1539i
-0.2604 - 0.0885i	0.0000 + 0.0000i	0.2609 + 0.0869i	-0.2026 + 0.0625i	-0.2171 + 0.1116i	-0.2022 + 0.0638i
0.2651 - 0.1374i	-0.0343 + 0.0758i	-0.3367 - 0.5489i	0.1506 + 0.1558i	-0.0059 + 0.0158i	0.2387 - 0.1902i
-0.8505 - 0.2608i	0.3291 + 0.1735i	-0.1155 - 0.1628i	0.2059 - 0.0447i	-0.0725 + 0.0730i	-0.5340 + 0.1983i
0.0890 + 0.0123i	-0.0000 - 0.0000i	-0.0891 - 0.0118i	0.0743 - 0.0481i	-0.0081 - 0.0490i	0.0741 - 0.0486i
0.1135 + 0.1642i	-0.3280 - 0.1754i	0.8504 + 0.2608i	-0.5362 + 0.1915i	-0.0729 + 0.0725i	0.2059 - 0.0446i

Columns 13 through 18

-0.0399 - 0.0471i	-0.0695 + 0.1332i	-0.0957 - 0.0066i	0.5546 - 0.4646i	0.0262 + 0.0591i	-0.1948 + 0.4898i
-0.0215 + 0.0476i	-0.0000 + 0.0000i	0.0212 - 0.0477i	-0.3988 + 0.4117i	0.0000 + 0.0000i	0.3963 - 0.4141i
0.0956 + 0.0078i	0.0703 - 0.1327i	0.0400 + 0.0471i	0.2007 - 0.4877i	-0.0259 - 0.0593i	-0.5546 + 0.4646i
-0.0095 + 0.0080i	-0.0384 + 0.0001i	0.0181 - 0.0530i	0.1489 + 0.4355i	-0.0042 + 0.0395i	-0.1955 - 0.2833i
0.0020 - 0.0402i	0.0000 - 0.0000i	-0.0017 + 0.0402i	-0.3096 - 0.4330i	-0.0000 + 0.0000i	0.3122 + 0.4311i
-0.0188 + 0.0527i	0.0384 + 0.0002i	0.0095 - 0.0081i	0.1921 + 0.2858i	0.0045 - 0.0395i	-0.1489 - 0.4355i
0.0829 - 0.0519i	-0.0459 - 0.1664i	0.0610 + 0.0535i	-1.0432 - 0.3363i	-0.3375 - 0.0488i	0.5996 + 0.2662i
-0.0108 + 0.0863i	0.0000 + 0.0000i	0.0102 - 0.0864i	1.1046 + 0.2261i	0.0000 - 0.0000i	-1.1059 - 0.2193i
-0.0603 + 0.0542i	0.0449 + 0.1666i	-0.0828 + 0.0519i	-0.5964 - 0.2735i	0.3371 + 0.0509i	1.0431 + 0.3363i
0.1561 + 0.2637i	0.0468 - 0.1792i	0.0892 - 0.0771i	-0.1100 + 0.0955i	-0.0325 - 0.1022i	-0.1160 - 0.3515i
-0.0118 - 0.0037i	-0.1524 + 0.0367i	-0.0118 - 0.0036i	0.0301 + 0.0743i	-0.0537 + 0.0423i	0.0305 + 0.0741i
0.0901 - 0.0760i	0.0479 - 0.1789i	0.1561 + 0.2637i	-0.1118 - 0.3532i	-0.0319 - 0.1024i	-0.1100 + 0.0956i
-0.1911 - 0.0785i	0.2552 + 0.0100i	-0.2042 - 0.0681i	0.1361 + 0.1909i	0.0243 + 0.0074i	0.2167 - 0.0170i
0.0064 - 0.1412i	-0.2936 - 0.5112i	0.0055 - 0.1412i	-0.1781 - 0.0844i	-0.0416 - 0.1728i	-0.1786 - 0.0833i
-0.2034 - 0.0705i	0.2552 + 0.0116i	-0.1911 - 0.0785i	0.2169 - 0.0143i	0.0243 + 0.0076i	0.1360 + 0.1908i
0.2104 - 0.2381i	-0.0721 - 0.1253i	0.0946 + 0.1355i	-2.0860 - 0.2487i	0.0925 - 0.0284i	0.4906 + 0.1888i
0.0029 - 0.0077i	0.0984 + 0.1915i	0.0028 - 0.0077i	0.3122 - 0.0000i	0.2856 + 0.0277i	0.3122 - 0.0020i
0.0929 + 0.1367i	-0.0713 - 0.1257i	0.2103 - 0.2381i	0.4882 + 0.1948i	0.0927 - 0.0278i	-2.0859 - 0.2486i

SG.S12 =  
Columns 1 through 6

-1.8592 - 0.3625i	0.5795 + 0.1520i	-0.5202 - 0.2952i	-0.5053 - 0.9160i	0.5012 - 0.2921i	-0.2891 - 0.4538i
0.8276 + 0.3710i	-1.4062 - 0.1763i	0.8299 + 0.3660i	0.2393 + 0.6240i	-0.5823 + 0.1328i	0.2432 + 0.6226i
-0.5166 - 0.3015i	0.5786 + 0.1556i	-1.8594 - 0.3626i	-0.2837 - 0.4573i	0.5030 - 0.2891i	-0.5053 - 0.9160i
0.4698 - 0.1917i	-0.3354 + 0.1257i	0.4479 + 0.0658i	-0.5398 + 0.1654i	-0.0139 + 0.2587i	0.2840 + 0.1579i
-0.5747 + 0.2157i	0.4770 - 0.2036i	-0.5734 + 0.2192i	-0.4674 - 0.0279i	-0.6911 + 0.1497i	-0.4676 - 0.0251i
0.4470 + 0.0713i	-0.3362 + 0.1236i	0.4698 - 0.1917i	0.2820 + 0.1614i	-0.0154 + 0.2586i	-0.5398 + 0.1654i
-0.0927 + 0.3388i	0.0639 - 0.3182i	-0.5496 + 0.3451i	-0.9073 + 0.4734i	-0.1567 - 0.5097i	-0.6459 + 0.0026i
0.2380 - 0.3820i	-0.0477 + 0.3141i	0.2358 - 0.3836i	0.6890 - 0.2534i	0.2308 + 0.5408i	0.6874 - 0.2576i
-0.5535 + 0.3380i	0.0658 - 0.3177i	-0.0928 + 0.3388i	-0.6458 - 0.0053i	-0.1536 - 0.5106i	-0.9072 + 0.4733i
1.9723 + 0.2394i	-0.5154 - 0.0800i	0.4977 + 0.1258i	0.1215 + 0.3660i	-0.2047 + 0.1940i	0.2652 + 0.1834i
-0.4804 - 0.0642i	-0.0000 + 0.0000i	0.4808 + 0.0612i	0.0466 - 0.0120i	-0.0000 + 0.0000i	-0.0465 + 0.0123i
-0.4962 - 0.1319i	0.5150 + 0.0832i	-1.9725 - 0.2395i	-0.2631 - 0.1867i	0.2059 - 0.1928i	-0.1215 - 0.3661i
-0.1842 + 0.1279i	0.0048 - 0.0796i	0.1612 + 0.1065i	-0.0413 + 0.0735i	-0.0961 - 0.0459i	-0.0635 + 0.2135i
0.2991 - 0.0917i	0.0000 - 0.0000i	-0.2986 + 0.0936i	-0.0080 + 0.0743i	0.0000 - 0.0000i	0.0075 - 0.0744i
-0.1598 - 0.1084i	-0.0053 + 0.0796i	0.1843 - 0.1279i	0.0662 - 0.2127i	0.0958 + 0.0465i	0.0414 - 0.0734i
-0.2202 - 0.0217i	0.1644 - 0.1581i	-0.6228 + 0.1917i	-0.3413 + 0.0867i	-0.1277 - 0.2831i	-0.4373 - 0.1139i
-0.0868 + 0.0661i	-0.0000 + 0.0000i	0.0864 - 0.0667i	-0.0318 - 0.0243i	-0.0000 + 0.0000i	0.0320 + 0.0241i
0.6249 - 0.1838i	-0.1653 + 0.1570i	0.2202 + 0.0217i	0.4357 + 0.1193i	0.1260 + 0.2838i	0.3413 - 0.0867i

Columns 7 through 12

0.4519 - 0.4035i	-0.3372 + 0.2932i	0.1066 - 0.5338i	2.1447 + 0.3315i	-0.0334 + 0.0092i	-0.8287 - 0.2687i
-0.3413 + 0.4083i	0.2972 - 0.2389i	-0.3388 + 0.4102i	-0.7258 - 0.3391i	0.0000 + 0.0000i	0.7279 + 0.3347i
0.1131 - 0.5328i	-0.3390 + 0.2912i	0.4519 - 0.4034i	0.8254 + 0.2787i	0.0335 - 0.0090i	-2.1448 - 0.3316i
0.2216 + 0.4869i	-0.1186 - 0.3038i	0.2411 + 0.2424i	-0.5699 + 0.2866i	0.0200 + 0.0151i	0.4286 + 0.0119i
-0.3593 - 0.4884i	0.1171 + 0.5136i	-0.3622 - 0.4861i	0.5992 - 0.1888i	-0.0000 - 0.0000i	-0.5981 + 0.1925i
0.2382 + 0.2454i	-0.1168 - 0.3045i	0.2216 + 0.4868i	-0.4283 - 0.0171i	-0.0199 - 0.0152i	0.5699 - 0.2866i
-1.9019 - 0.3398i	0.5224 + 0.2432i	-0.5768 - 0.2264i	0.1594 - 0.2784i	-0.0783 + 0.0469i	-0.5385 + 0.3685i
0.9699 + 0.1946i	-1.4062 - 0.1763i	0.9710 + 0.1887i	-0.1185 + 0.4180i	0.0000 - 0.0000i	0.1160 - 0.4188i
-0.5741 - 0.2334i	0.5209 + 0.2463i	-1.9017 - 0.3398i	0.5428 - 0.3617i	0.0785 - 0.0464i	-0.1594 + 0.2784i
-0.0746 + 0.0450i	0.1110 - 0.1931i	0.1831 + 0.3894i	-1.1989 - 0.2210i	-0.5551 - 0.0066i	0.2480 + 0.1216i







RCWA Benchmark Data  
3x3 Spatial Harmonics



1.5238	0	0	0	0	0	0	0	0	0	4.6939	0	0	0
0	0	-1.5238	0	0	0	0	0	0	0	0	6.0000	0	0
0	0	0	0	0	0	0	0	0	0	0	0	4.6939	0
0	0	0	0	0	0	0	0	0	0	0	0	0	4.6939
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	-1.5238	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4.2222	0	0	0	0	0	0	0	0	1.5238	0	0	0	0
0	-4.2222	0	0	0	0	0	0	0	0	-1.5238	0	0	0
0	0	-4.2222	0	0	0	0	0	0	0	0	0	0	0
0	0	0	-6.0000	0	0	0	0	0	0	0	0	1.5238	0
0	0	0	0	-6.0000	0	0	0	0	0	0	0	0	0
0	0	0	0	0	-6.0000	0	0	0	0	0	0	0	0
0	0	0	0	0	0	-6.0000	0	0	0	0	0	0	0
0	0	0	0	0	0	0	-4.2222	0	0	0	0	0	0
0	0	0	0	0	0	0	0	-4.2222	0	0	0	0	0
0	0	0	0	0	0	0	0	0	-4.2222	0	0	0	0

Columns 14 through 18

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
6.0000	0	0	0	0
0	4.6939	0	0	0
0	0	4.6939	0	0
0	0	0	6.0000	0
0	0	0	0	4.6939
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	1.5238	0	0
0	0	0	0	0
0	0	0	0	-1.5238

OMEGA\_SQ =  
Columns 1 through 13

-2.9161	0	0	0	0	0	0	0	0	0	0	0	0	0
0	-4.2222	0	0	0	0	0	0	0	0	0	0	0	0
0	0	-2.9161	0	0	0	0	0	0	0	0	0	0	0
0	0	0	-4.6939	0	0	0	0	0	0	0	0	0	0
0	0	0	0	-6.0000	0	0	0	0	0	0	0	0	0
0	0	0	0	0	-4.6939	0	0	0	0	0	0	0	0
0	0	0	0	0	0	-2.9161	0	0	0	0	0	0	0
0	0	0	0	0	0	0	-4.2222	0	0	0	0	0	0
0	0	0	0	0	0	0	0	-2.9161	0	0	0	0	0
0	0	0	0	0	0	0	0	0	-2.9161	0	0	0	0
0	0	0	0	0	0	0	0	0	0	-4.2222	0	0	0
0	0	0	0	0	0	0	0	0	0	0	-2.9161	0	0
0	0	0	0	0	0	0	0	0	0	0	0	-4.6939	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0

Columns 14 through 18

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
-6.0000	0	0	0	0
0	-4.6939	0	0	0
0	0	-2.9161	0	0
0	0	0	-4.2222	0
0	0	0	0	-2.9161

W =  
Columns 1 through 6

1.0000 + 0.0000i	0.1197 + 0.1796i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.0368 - 0.0046i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	1.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.9229 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	1.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	1.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.9746 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.0321 + 0.0414i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	-0.0329 - 0.0494i	0.0000 + 0.0000i	0.0000 + 0.0000i	-0.3741 + 0.0161i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0264 + 0.0573i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i















































EE 5337

RCWA Benchmark Data
3x3 Spatial Harmonics

Table with 12 columns of numerical values, representing spatial harmonics data.

Columns 13 through 18

Table with 12 columns of numerical values, representing spatial harmonics data for columns 13 through 18.

SG.S12 =

Columns 1 through 6

Table with 12 columns of numerical values, representing spatial harmonics data for columns 1 through 6.

Columns 7 through 12

Table with 12 columns of numerical values, representing spatial harmonics data for columns 7 through 12.

Columns 13 through 18

Table with 12 columns of numerical values, representing spatial harmonics data for columns 13 through 18.



RCWA Benchmark Data  
3x3 Spatial Harmonics



SG.S21 =

Columns 1 through 6

-0.3301	+ 0.2465i	0.0761	+ 0.0727i	-0.0251	- 0.0252i	-0.0030	+ 0.2763i	-0.0191	- 0.1022i	0.0065	+ 0.0058i
0.1117	+ 0.0223i	0.0328	+ 0.3052i	0.1118	+ 0.0216i	-0.0575	- 0.0757i	0.1047	+ 0.0981i	-0.0580	- 0.0754i
-0.0248	- 0.0255i	0.0756	+ 0.0732i	-0.3301	+ 0.2466i	0.0064	+ 0.0059i	-0.0185	- 0.1023i	-0.0030	+ 0.2763i
0.1275	+ 0.0018i	-0.0513	+ 0.0140i	0.0689	- 0.0004i	0.2487	+ 0.6631i	0.1271	- 0.0151i	-0.0224	- 0.0257i
-0.0613	+ 0.0296i	0.0230	- 0.0590i	-0.0611	+ 0.0299i	0.1520	- 0.0638i	0.5048	+ 0.2107i	0.1516	- 0.0648i
0.0689	+ 0.0005i	-0.0513	+ 0.0136i	0.1275	+ 0.0018i	-0.0221	- 0.0260i	0.1271	- 0.0143i	0.2487	+ 0.6631i
-0.0364	+ 0.0006i	0.0115	- 0.0028i	-0.0711	+ 0.0345i	0.2906	- 0.0006i	-0.1251	- 0.0205i	0.0029	+ 0.0656i
0.0187	+ 0.0123i	0.0141	+ 0.0038i	0.0188	+ 0.0122i	-0.1395	+ 0.0342i	0.0772	- 0.1101i	-0.1393	+ 0.0351i
-0.0715	+ 0.0336i	0.0115	- 0.0027i	-0.0364	+ 0.0006i	0.0021	+ 0.0656i	-0.1250	- 0.0212i	0.2906	- 0.0006i
-0.2879	- 0.5866i	-0.0369	- 0.0389i	-0.1099	+ 0.0600i	-0.0043	+ 0.0043i	0.0129	+ 0.0646i	-0.0045	- 0.0418i
-0.1184	+ 0.2106i	0.0000	+ 0.0000i	0.1170	- 0.2113i	-0.0189	- 0.0444i	0.0000	+ 0.0000i	0.0192	+ 0.0443i
0.1106	- 0.0586i	0.0366	+ 0.0391i	0.2879	+ 0.5866i	0.0040	+ 0.0419i	-0.0125	- 0.0646i	0.0043	- 0.0043i
0.0478	+ 0.1159i	0.0094	+ 0.0012i	0.0789	- 0.0445i	0.0046	+ 0.0038i	-0.0132	+ 0.0024i	0.0265	- 0.0042i
-0.0249	- 0.0944i	-0.0000	+ 0.0000i	0.0254	+ 0.0942i	0.0134	- 0.0079i	0.0000	+ 0.0000i	-0.0134	+ 0.0080i
-0.0794	+ 0.0435i	-0.0094	- 0.0013i	-0.0478	- 0.1159i	-0.0265	+ 0.0038i	0.0133	- 0.0023i	-0.0046	- 0.0038i
0.0126	+ 0.0186i	0.0027	- 0.0024i	-0.0330	- 0.0642i	-0.0064	- 0.0005i	-0.0557	- 0.0076i	0.0530	+ 0.1244i
-0.0104	- 0.0051i	0.0000	+ 0.0000i	0.0104	+ 0.0050i	0.0380	+ 0.0069i	-0.0000	+ 0.0000i	-0.0381	- 0.0067i
0.0322	+ 0.0646i	-0.0027	+ 0.0024i	-0.0126	- 0.0186i	-0.0514	- 0.1251i	0.0557	+ 0.0079i	0.0064	+ 0.0005i

Columns 7 through 12

0.0205	+ 0.1455i	-0.0293	- 0.0139i	-0.0066	- 0.0048i	-0.2708	- 0.5894i	-0.0062	+ 0.0315i	-0.0150	- 0.0083i
-0.0107	- 0.0082i	0.0521	- 0.0071i	-0.0107	- 0.0082i	-0.1072	+ 0.1518i	-0.0000	+ 0.0000i	0.1063	- 0.1525i
-0.0065	- 0.0049i	-0.0292	- 0.0141i	0.0205	+ 0.1455i	0.0149	+ 0.0085i	0.0064	+ 0.0315i	0.2708	+ 0.5894i
0.0060	+ 0.1128i	-0.0224	- 0.0308i	0.0160	- 0.0132i	0.1009	+ 0.1942i	-0.0639	- 0.0006i	0.0391	+ 0.0188i
-0.0519	- 0.0084i	-0.0604	+ 0.0313i	-0.0519	- 0.0080i	-0.0394	- 0.1113i	-0.0000	+ 0.0000i	0.0401	+ 0.1110i
0.0162	- 0.0130i	-0.0223	- 0.0310i	0.0060	+ 0.1128i	-0.0389	- 0.0193i	0.0639	+ 0.0010i	-0.1009	- 0.1942i
-0.3277	+ 0.2478i	0.0721	+ 0.0712i	-0.0532	- 0.0243i	-0.0653	- 0.0094i	0.0671	+ 0.0027i	-0.0239	- 0.0656i
0.1252	+ 0.0132i	0.0329	+ 0.3060i	0.1252	+ 0.0124i	0.0230	+ 0.0185i	0.0000	- 0.0000i	-0.0231	- 0.0183i
-0.0529	- 0.0250i	0.0717	+ 0.0716i	-0.3277	+ 0.2478i	0.0231	+ 0.0659i	-0.0671	- 0.0031i	0.0653	+ 0.0094i
0.0023	+ 0.0230i	0.0201	+ 0.0008i	0.0146	- 0.0031i	-0.4260	+ 0.0715i	0.2810	+ 0.3156i	0.1502	- 0.0728i
-0.0120	+ 0.0205i	0.0000	+ 0.0000i	0.0118	- 0.0205i	0.0261	+ 0.1709i	0.0352	+ 0.8662i	0.0271	+ 0.1707i
0.0146	+ 0.0029i	-0.0201	- 0.0009i	-0.0023	- 0.0230i	0.1510	- 0.0709i	0.2790	+ 0.3173i	-0.4260	+ 0.0715i
0.1573	- 0.0486i	0.0052	- 0.0022i	-0.0105	+ 0.0078i	0.0764	- 0.0528i	-0.1338	+ 0.0439i	0.0079	+ 0.0651i
-0.0785	+ 0.0551i	0.0000	+ 0.0000i	0.0782	- 0.0556i	-0.0494	+ 0.0076i	0.0705	- 0.1371i	-0.0494	+ 0.0079i
0.0106	- 0.0076i	-0.0052	- 0.0021i	-0.1573	+ 0.0486i	0.0071	+ 0.0652i	-0.1340	+ 0.0431i	0.0764	- 0.0528i
0.2877	+ 0.5836i	0.0309	+ 0.0353i	0.0987	- 0.0482i	0.0210	+ 0.0243i	-0.0234	+ 0.0125i	-0.0595	+ 0.0526i
0.1169	- 0.2141i	0.0000	+ 0.0000i	-0.1155	+ 0.2148i	0.0094	- 0.0150i	0.0097	- 0.0036i	0.0093	- 0.0151i
-0.0993	+ 0.0470i	-0.0307	- 0.0355i	-0.2877	- 0.5836i	-0.0602	+ 0.0519i	-0.0235	+ 0.0123i	0.0210	+ 0.0243i

Columns 13 through 18

-0.0054	- 0.0631i	0.0268	+ 0.0588i	-0.0168	- 0.0146i	0.0637	- 0.1741i	0.0980	+ 0.0223i	-0.0010	+ 0.0092i
-0.0079	+ 0.0030i	0.0000	+ 0.0000i	0.0078	- 0.0030i	-0.0349	+ 0.0612i	-0.0000	- 0.0000i	0.0345	- 0.0614i
0.0166	+ 0.0148i	-0.0264	- 0.0589i	0.0054	+ 0.0631i	0.0011	- 0.0092i	-0.0978	- 0.0229i	-0.0637	+ 0.1741i
0.0011	- 0.0012i	-0.0134	+ 0.0036i	0.0150	- 0.0028i	0.1911	- 0.0848i	0.0219	+ 0.0525i	-0.0010	+ 0.0006i
0.0070	- 0.0037i	0.0000	+ 0.0000i	-0.0070	+ 0.0037i	-0.0705	+ 0.0385i	0.0000	+ 0.0000i	0.0703	- 0.0390i
-0.0150	+ 0.0026i	0.0134	- 0.0035i	-0.0011	+ 0.0012i	0.0010	- 0.0006i	-0.0216	- 0.0526i	-0.1911	+ 0.0848i
0.0613	- 0.0015i	-0.0569	- 0.0036i	0.0140	+ 0.0276i	0.2702	+ 0.5953i	0.0044	+ 0.0583i	-0.0078	+ 0.0154i
-0.0105	- 0.0034i	-0.0000	+ 0.0000i	0.0105	+ 0.0033i	0.1023	- 0.1511i	-0.0000	+ 0.0000i	-0.1013	+ 0.1518i
-0.0137	- 0.0278i	0.0569	+ 0.0039i	-0.0613	+ 0.0015i	0.0080	- 0.0153i	-0.0048	+ 0.0583i	-0.2702	- 0.5953i
0.0090	+ 0.1115i	-0.0263	- 0.0824i	0.0150	+ 0.0045i	0.0194	- 0.0169i	0.0085	+ 0.0128i	0.0043	- 0.0194i
-0.0274	- 0.0535i	0.0699	+ 0.1017i	-0.0277	- 0.0533i	-0.0090	+ 0.0232i	0.0534	- 0.0103i	-0.0089	+ 0.0233i
0.0149	+ 0.0047i	-0.0258	- 0.0825i	0.0090	+ 0.1115i	0.0045	- 0.0194i	0.0084	+ 0.0129i	0.0194	- 0.0169i
0.1822	+ 0.4143i	0.1382	- 0.0589i	-0.0345	- 0.0101i	0.0167	+ 0.0869i	-0.0792	- 0.1047i	0.0032	- 0.0316i
0.0862	- 0.0612i	0.5145	+ 0.2249i	0.0859	- 0.0617i	-0.0181	- 0.0239i	0.1676	+ 0.1127i	-0.0182	- 0.0238i
-0.0344	- 0.0105i	0.1386	- 0.0581i	0.1822	+ 0.4143i	0.0036	- 0.0151i	-0.0786	- 0.1052i	0.0167	+ 0.0869i
0.0955	+ 0.0165i	-0.0896	- 0.0165i	0.0126	+ 0.0606i	-0.4259	+ 0.0703i	0.2548	+ 0.3116i	0.1271	- 0.0689i
-0.0668	+ 0.0097i	0.0809	- 0.0620i	-0.0667	+ 0.0101i	0.0475	+ 0.1686i	0.0379	+ 0.8660i	0.0486	+ 0.1683i
0.0119	+ 0.0607i	-0.0895	- 0.0171i	0.0955	- 0.0165i	0.1279	- 0.0674i	0.2529	+ 0.3132i	-0.4259	+ 0.0703i

SG.S22 =

Columns 1 through 6

0.3024	- 0.1665i	-0.1092	- 0.0488i	-0.1688	+ 0.0941i	-0.0004	- 0.1236i	-0.0261	+ 0.0963i	0.0361	- 0.0313i
-0.1104	- 0.0059i	-0.4257	+ 0.2849i	-0.1104	- 0.0053i	-0.0369	+ 0.0057i	0.0736	+ 0.0687i	-0.0369	+ 0.0059i
-0.1699	+ 0.0921i	-0.1089	- 0.0495i	0.3024	- 0.1665i	0.0365	- 0.0309i	-0.0267	+ 0.0961i	-0.0004	- 0.1236i
-0.0793	+ 0.0797i	-0.0084	- 0.0145i	0.0765	- 0.1297i	0.1246	+ 0.1254i	0.0109	- 0.0673i	-0.0425	+ 0.0368i
0.0512	- 0.0117i	0.0609	- 0.0734i	0.0511	- 0.0120i	0.0122	- 0.0728i	0.3048	+ 0.2105i	0.0118	- 0.0728i
0.0781	- 0.1288i	-0.0084	- 0.0146i	-0.0793	+ 0.0797i	-0.0430	+ 0.0363i	0.0113	- 0.0673i	0.1246	+ 0.1254i
-0.0263	- 0.0674i	0.0091	+ 0.0203i	-0.1304	+ 0.1910i	-0.1195	+ 0.0409i	0.0725	+ 0.0046i	0.0755	- 0.1513i
0.0088	+ 0.0287i	0.0336	+ 0.0368i	0.0089	+ 0.0287i	-0.0101	- 0.0176i	0.0680	- 0.0819i	-0.1020	- 0.0175i
-0.1327	+ 0.1893i	0.0090	+ 0.0204i	-0.0263	- 0.0674i	0.0774	- 0.1504i	0.0725	+ 0.0050i	-0.1195	+ 0.0409i
-0.4760	- 0.4063i	0.0506	+ 0.1696i	-0.1307	- 0.0512i	-0.2056	+ 0.1592i	0.0201	- 0.1055i	0.0010	+ 0.0565i
-0.0959	+ 0.2186i	0.0000	+ 0.0000i	0.0945	- 0.2191i	0.0749	+ 0.0433i	-0.0000	+ 0.0000i	-0.0752	- 0.0429i
0.1301	+ 0.0528i	-0.0496	- 0.1700i	0.4760	+ 0.4063i	-0.0003	- 0.0565i	-0.0207	+ 0.1054i	0.2056	- 0.1592i
0.1242	+ 0.0532i	-0.0463	- 0.0250i	0.0582	- 0.0587i	-0.0141	- 0.0011i	0.0346	- 0.0034i	-0.0535	- 0.0243i
-0.0645	- 0.0513i	0.0000	+ 0.0000i	0.0648	+ 0.0509i	-0.0251	- 0.0021i	-0.0000	+ 0.0000i	0.0251	+ 0.0019i
-0.0589	+ 0.0579i	0.0461	+ 0.0253i	-0.1242	- 0.0532i	0.0532	+ 0.0250i	-0.0347	+ 0.0032i	0.0141	+ 0.0011i
0.0473	+ 0.0399i	0.0048	- 0.0266i	0.0277	+ 0.0006i	-0.1556	- 0.2190i	0.0991	+ 0.0793i	-0.0382	- 0.0452i
0.0025	- 0.0238i	-0.0000	+ 0.0000i	-0.0023	+ 0.0238i	-0.0126	+ 0.0877i	0.0000	+ 0.0000i	0.0120	- 0.0878i
-0.0277	- 0.0009i	-0.0050	+ 0.0266i	-0.0473	- 0.0399i	0.0376	+ 0.0457i	-0.0986	- 0.0799i	0.1556	+ 0.2190i

Columns 7 through 12

-0.1207	+ 0.0078i	0.0812	+ 0.0420i	0.0040	- 0.0149i	-0.4812	- 0.3998i	-0.0725	+ 0.2944i	0.1233	+ 0.0135i
0.0844	+ 0.0377i	0.0037	+ 0.0590i	0.0847	+ 0.0371i	0.0205	+ 0.1848i	0.0000	- 0.0000i	-0.0216	- 0.1847i
0.0041	- 0.0149i	0.0809	+ 0.0426i	-0.1207	+ 0.0078i	-0.1231	- 0.0150i	0.0743	- 0.2940i	0.4812	+ 0.3998i
-0.0400	- 0.0824i	-0.0306	+ 0.0049i	0.0332	- 0.0178i	0.1287	+ 0.2214i	0.0124	- 0.0906i	-0.0518	- 0.0149i
-0.0221	+ 0.0732i	0.0660	+ 0.0615i	-0.0217	+ 0.0733i	-0.0888	- 0.0832i	0.0000	+ 0.0000i	0.0893	+ 0.0826i
0.0334	- 0.0174i	-0.0306	+ 0.0047i	-0.0400	- 0.0824i	0.0516	+ 0.0155i	-0.0130	+ 0.0906i	-0.1287	- 0.2214i
0.3040	- 0.1662i	-0.1083	- 0.0395i	-0.1711	+ 0.0897i	-0.0449	- 0.0470i	-0.0016	+ 0.0139i	0.0276	- 0.0002i
-0.1088	- 0.0150i	-0.4257	+ 0.2849i	-0.1089	- 0.0144i	-0.0038	+ 0.0360i	-0.0000	+ 0.0000i	0.0036	- 0.0361i
-0											



RCWA Benchmark Data  
3x3 Spatial Harmonics

```
ctrn =  
0.0268 + 0.0588i  
0.0000 + 0.0000i  
-0.0264 - 0.0589i  
-0.0134 + 0.0036i  
0.0000 + 0.0000i  
0.0134 - 0.0035i  
-0.0569 - 0.0036i  
-0.0000 + 0.0000i  
0.0569 + 0.0039i  
-0.0263 - 0.0824i  
0.0699 + 0.1017i  
-0.0258 - 0.0825i  
0.1382 - 0.0589i  
0.5145 + 0.2249i  
0.1386 - 0.0581i  
-0.0896 - 0.0165i  
0.0809 - 0.0620i  
-0.0895 - 0.0171i
```

```
eref =  
-0.0094 - 0.0369i  
0.0000 + 0.0000i  
0.0092 + 0.0369i  
0.0012 - 0.0042i  
0.0000 + 0.0000i  
-0.0012 + 0.0042i  
0.0374 + 0.0158i  
0.0000 - 0.0000i  
-0.0373 - 0.0160i  
0.0432 + 0.0301i  
-0.0265 - 0.0191i  
0.0430 + 0.0304i  
-0.1028 + 0.0241i  
-0.2706 - 0.0715i  
-0.1029 + 0.0235i  
0.0378 - 0.0313i  
-0.0199 + 0.0283i  
0.0380 - 0.0310i
```

```
etrn =  
0.0268 + 0.0588i  
0.0000 + 0.0000i  
-0.0264 - 0.0589i  
-0.0134 + 0.0036i  
0.0000 + 0.0000i  
0.0134 - 0.0035i  
-0.0569 - 0.0036i  
-0.0000 + 0.0000i  
0.0569 + 0.0039i  
-0.0263 - 0.0824i  
0.0699 + 0.1017i  
-0.0258 - 0.0825i  
0.1382 - 0.0589i  
0.5145 + 0.2249i  
0.1386 - 0.0581i  
-0.0896 - 0.0165i  
0.0809 - 0.0620i  
-0.0895 - 0.0171i
```

```
rx =  
-0.0094 - 0.0369i  
0.0000 + 0.0000i  
0.0092 + 0.0369i  
0.0012 - 0.0042i  
0.0000 + 0.0000i  
-0.0012 + 0.0042i  
0.0374 + 0.0158i  
0.0000 - 0.0000i  
-0.0373 - 0.0160i
```

```
ry =  
0.0432 + 0.0301i  
-0.0265 - 0.0191i  
0.0430 + 0.0304i  
-0.1028 + 0.0241i  
-0.2706 - 0.0715i  
-0.1029 + 0.0235i  
0.0378 - 0.0313i  
-0.0199 + 0.0283i  
0.0380 - 0.0310i
```

```
rz =  
0.0019 + 0.0450i  
-0.0750 - 0.0541i  
0.0016 + 0.0450i  
0.0017 - 0.0057i  
0.0000 + 0.0000i  
0.0017 - 0.0057i  
-0.0574 - 0.0074i  
0.0562 - 0.0801i  
-0.0573 - 0.0078i
```

```
tx =  
0.0268 + 0.0588i  
0.0000 + 0.0000i  
-0.0264 - 0.0589i  
-0.0134 + 0.0036i  
0.0000 + 0.0000i  
0.0134 - 0.0035i  
-0.0569 - 0.0036i  
-0.0000 + 0.0000i  
0.0569 + 0.0039i
```

RCWA Benchmark Data  
3x3 Spatial Harmonics

ty =  
-0.0263 - 0.0824i  
0.0699 + 0.1017i  
-0.0258 - 0.0825i  
0.1382 - 0.0589i  
0.5145 + 0.2249i  
0.1386 - 0.0581i  
-0.0896 - 0.0165i  
0.0809 - 0.0620i  
-0.0895 - 0.0171i

tz =  
0.0019 + 0.0175i  
-0.0347 - 0.0504i  
0.0018 + 0.0176i  
0.0055 - 0.0015i  
0.0000 + 0.0000i  
0.0055 - 0.0014i  
-0.0224 - 0.0074i  
0.0401 - 0.0308i  
-0.0223 - 0.0075i

===== STEP 12: DIFFRACTION EFFICIENCIES

R =  
0 0.0066 0  
0.0032 0.0783 0.0036  
0 0.0066 0

T =  
0.0206 0.0447 0.0208  
0.0360 0.6689 0.0246  
0.0206 0.0447 0.0208

REF = 0.098299  
TRN = 0.9017

===== STEP 13: CONSERVATION

REF = 9.8299%  
TRN = 90.1701%  
-----  
CON = 100%